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Biological Warfare and Bioterrorism

W artykule zaprezentowano możliwości wykorzystania broni biologicznej w działaniach terrorystycznych. Autorka przedstawia rozwój badań nad bronią biologiczną w ostatnich 50 latach, wysnuwając tezę, że stałą się ona jednym z najważniejszych zagrożeń współczesnego świata. Łatwy dostęp i niskie koszty wytwarzania stwarzają nieograniczone możliwości jej wykorzystania. Bioterroryzm stanowi więc jedno z największych, potencjalnych zagrożeń współczesnego świata.

A threat of bioterrorism is old in the sense that it is a historic tool of war and new in the sense that it is viewed as a present and clear danger in the post 9-11 era. The anthrax attacks of 2001 and more recent use of terrorism on civilian targets in Madrid and London reinforces the need to address all potential terrorist threats. Therefore, counterterrorism efforts need to focus on conventional warfare techniques as well as weapons of mass destruction. (WMD) incorporating, inter alia, biological materials that would cause incalculable damage in urban settings.

'Biological Warfare' (BW) is defined as the 'employment of biological agents to produce casualties in man or animals or damage to plants.'[1] The deliberate use of microorganisms and toxins as weapons has been attempted throughout history. Ease of production, the broad availability of biological agents and technical know how have led to a further spread of biological weapons and an increased desire among developing countries to have them.

Biological terrorism is intentionally to use infectious substances for developing diseases or death in animals or humans, leading to disaster and panic in the community. Although bioterrorism is not a new threat, it is progressively becoming more and more worrisome. Many leaders have described biological weapons, particularly in the hands of terrorists, as the most insidious threat to international peace and security. For instance, in 2001 French president Jacques Chirac said that biological weapons are "possibly the most fearsome weapons of mass destruction," noting that the Biological Weapons Convention 1972 was "incomplete" and stating that obstacles to improving the treaty regime "can be overcome if there is the political will to do so"[2].

Advancements in the life sciences are greater than ever, but so too are the destructive capabilities they bring. During the past century, the progress made in biotechnology has simplified the production and development of such weapon. Even as they have advanced our treatment of disease, the achievements of modern biomedical research have also increased people's ability to misuse discoveries in ways that could threaten the public health

[1] North Atlantic Treaty Organization. NATO handbook on the medical aspects of NBC defensive operations. Part II – Biological. NATO Amed P-6(B) Anonymous1996.

[2] *Speech by Mr. Jaques Chirac, President of the French Republic, to the Institute of Higher National Defence Studies,* Paris, June 8, 2001, http://www.delegfrance-cdgeneve. org/chapter1/Chirac_IHDEN_080601_eng.htm.

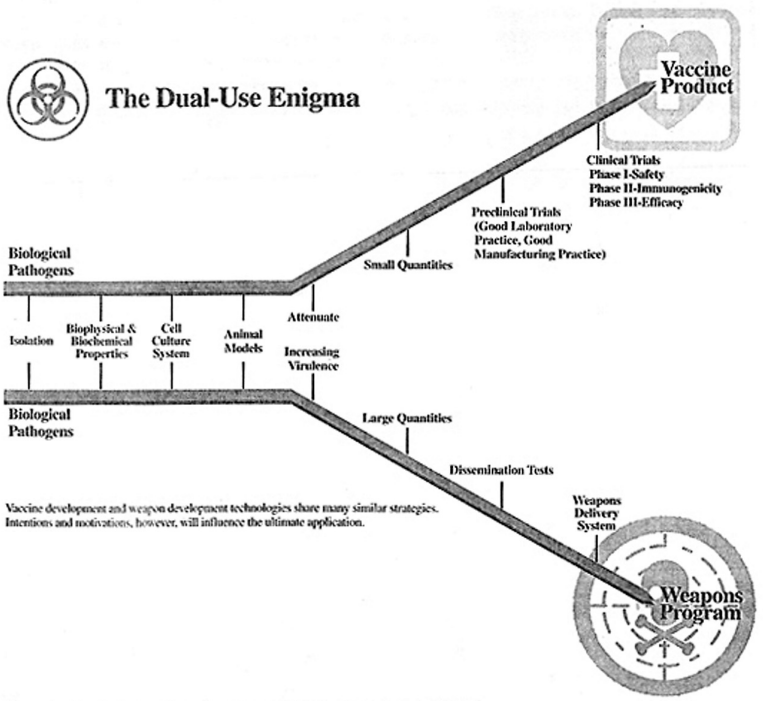
or national security. Additionally, genetic engineering holds perhaps the most dangerous potential.

In the uncertain environment created by international terrorism, one does not know what threats or tactics will be used to create biological incidents. Therefore, a wide range of potential threats must be considered, and a number of factors related to each potential threat scenario must be addressed, including potential adversaries, hazards, threat delivery mechanisms and targets. Multiple combinations of the above factors are possible.

Since the threat of bioterrorism is real, the risk posed by various microorganisms as biological weapons needs to be evaluated and the historical development and use of biological agents better understood. In this paper biological agents which could be used in bioterrorist attack, their advantages and disadvantages and the dual-use enigma are presented.

The phrase „dual-use research" attempts to capture the relation between scientific advances and the potential development of new pathogens or biologic weapons. Virtually all the equipment, materials and technology needed for a production of BW agent are dual--use. In consequence, very little distinguishes a pharmaceutical or vaccine plant from a BW production facility. „In the language of arms control and disarmament, dual use refers to technologies intended for civilian application that can also be used for military purposes," according to a 2003 report from a committee of the National Research Council on biotechnology. The technical skills required to run a program are consistent with relatively basic training in microbiology. Because of this dual-use nature of BW equipment and research, an offensive BW program could easily be disguised as a legitimate enterprise.

Fig. 1. The dual-use enigma (based on original by Huxsoll et al., 1989).



Research with a microbial discovery in pathology and epidemiology, resulting in the development of a vaccine to combat and control the outbreak of disease could be intentionally used with the aid of genetic engineering techniques to produce vaccine-resistant strains for terroristic or warfare purposes. The best known example, reported by UNSCOM, is the masquerading of an anthrax-weapon production facility as a routine civil biotechnological laboratory at Al Hakam.

Fig. 2. *Al Hakam Single-Cell Protein Plant*. Iraq's major facility for the production of biological warfare agents. Under the watchful eye of the United Nations Special Commission, this plant was destroyed by Iraqi workers in May and June of 1996; source: McGovern T. W., Christopher G. W., *Biological warfare and its cutaneous manifestations* [In:] *The Electronic Textbook of Dermatology.* Available at: www.telemedicine.org/biowar/bw01.htm.

The 1925 Geneva Protocol and the 1972 Biological and Toxin Weapons Convention (BWC) are treaties outlawing various activities associated with the use and acquisition of germ weapons; the international community however has allowed these treaties to atrophy.

The international community's first attempt to shape a global norm against biological weapons dates to the 1925 Geneva Protocol, which prohibits the use of biological and chemical weapons. As a hedge against nations not honoring the treaty's terms, nations such as e.g. the United Kingdom, France, China and the United States pledged to retaliate if other countries used biological or chemical weapons against their forces. The agreement was signed by a total of 108 nations, including eventually the 5 permanent members of the United Nations (UN) Security Council. However, the Geneva Protocol did not address verification or compliance, making it a "toothless" and less meaningful document. Therefore, several countries that were parties to the Geneva Protocol of 1925 began to develop biological weapons capabilities soon after its ratification. These countries included Great Britain, Belgium, Japan, Canada, Italy, France, the Netherlands, Poland and the Soviet Union. The USA did not ratify the Geneva Protocol until 1975.

During World War II, some of the mentioned countries began an ambitious biological warfare research program. The center of the Japanese biowarfare program, known as "Unit

731", was located in Manchuria near the town of Pingfan. More than 10,000 prisoners are believed to have died in consequence of experimental infection during the Japanese program between 1932 and 1945. At least 3000 of these victims were prisoners of war, including Korean, Chinese, Mongolian, American, British, Soviet and Australian soldiers.

Table 1. *Biological warfare programs during World War II*; source: Riedel S., *Biological warfare and bioterrorism: a historical review* [in:] *Proc (Bayl Univ Med Cent),* 2004 October; 17(4), p. 406.

Nation	Numbers of workers (estimated)	Focus
Germany	100-200	Offense research forbidden
Canada	small	Animal and crop diseases, rinderpest, anthrax
United Kingdom	40-50	Animal and crop diseases, anthrax, foot and mouth disease
Japan	several thousands	Extensive; official information suppressed by a treaty with USA in which all charges for war crimes were dropped for exchange of information from experiments
Soviet Union	several thousands	Typhus, plague
USA	1500-3000	Chemical herbicides, anthrax (started too late to be important)

In the USA, an offensive biological warfare program was begun in 1942 and included a research and development facility at Camp Detrick, Maryland (renamed Fort Detrick in 1956 and known today as the US Army Medical Research Institute of Infectious Diseases [USAMRIID]), testing sites in Mississippi and Utah, and a production facility in Terra Haute, Indiana. However, the production facility at Camp Detrick lacked adequate engineering safety measures, precluding a large-scale production of biological weapons during World War II.

Fig. 3. *Front of main building at USAMRIID on the grounds of Fort Detrick.*

Fig. 4. *Entrance to Fort Detrick with Maryland headquarters building in background.*

Source: McGovern T. W., Christopher G. W., *op. cit.*

The US program expanded during the Korean War (1950-1953) with the establishment of a new production facility in Pine Bluff, Arkansas and by the late 1960s, the US military had developed a biological arsenal. At Fort Detrick, biological munitions were detonated

inside a hollow 1-million-liter, metallic chamber known as the "eight ball". The studies were conducted to determine the vulnerability of humans to certain aerosolized pathogens. Volunteers inside this chamber were exposed to *Francisella tularensis* (tularemia) and *Coxiella burnetii* (Q fever).

Fig. 5a, 5b. *The "eight ball" one million liter test sphere at Fort Detrick, Maryland.*

5a

5b

Biological weapons research was continued in many other countries, including Britain, France, Canada and the Soviet Union.

During the post–World War II period some allegations occured:

- During the Korean War, North Korea, the Soviet Union and China accused the USA of using agents of biological warfare against North Korea
- The Eastern European press stated that Great Britain had used biological weapons in Oman in 1957.
- The Chinese alleged that the USA caused a cholera epidemic in Hong Kong in 1961.
- In July 1964, the Soviet newspaper *Pravda* asserted that the US Military Commission in Columbia and Colombian troops had used biological agents against peasants in Colombia and Bolivia.
- In 1969, Egypt accused the "imperialistic aggressors" of using biological weapons in the Middle East, specifically causing an epidemic of cholera in Iraq in 1966.
- In the 1970s, the USSR and its allies were suspected of having used „yellow rain" (trichothecene mycotoxins) during campaigns in Laos, Cambodia, and Afghanistan.

In November 1969, the World Health Organization issued a report regarding the possible consequences of the use of biological warfare agents (table 2).

Table 2. Approximately, the number of biological attack's victims (after pulverization 50 kg of biological agent in the air along the 2 km-long line from windward of the city having 500,000 inhabitants); source: WHO Group of Consultants. Health Aspects of Chemical and Biological Weapons. Geneva, Switzerland: World Health Organization; 1970.

Agent	Downwind reach (km)	Number killed	Number incapacitated
Rift Valley fever	1	400	35,000
Tickborne encephalitis	1	9500	35,000
Typhus	5	19,000	85,000
Brucellosis	10	500	125,000
Q-fever	>20	150	125,000
Tularemia	>20	30,000	125,000
Anthrax	>20	95,000	125,000

In the same year President Richard Nixon halted the American biological weapons program after being advised by his Joint Chiefs of Staff that germ weapons were militarily unreliable. After the termination of the offensive program, USAMRIID was established to continue research for development of medical defense for the US military against a potential attack with biological weapons. Nowadays, the USAMRIID is an open research institution and none of the research is classified.

In 1972 the United States and many other countries signed in BWC that went into effect in March 1975[3]. Signatories to the BWC are required to submit the following information to the UN on an annual basis: facilities where biological defense research is being conducted, scientific conferences that are held at specified facilities, exchange of information or scientists and disease outbreaks. The treaty prohibits the development, production and stockpiling of biological weapons for offensive military purposes and forbids research into offensive employment of biological agents. It does not however prohibit research and development of defensive measures against these agents. That is because such research is essential to develop medications and defensive capabilities. In addition, there are unresolved controversies about the definition of "defensive research" and the quantities of pathogens necessary for benevolent research. Research that can help scientists find a cure for a disease could also be the springboard to make that disease resistant to known vaccines and treatments. The thin line between legitimate research and activities designed to develop illicit weapons gives proliferators an edge and poses challenges for any attempt to monitor adherence to the BWC. Moreover, the treaty has no real on-site monitoring provisions. Arms control agreements incorporated inspectors only in the late 1980s, long after the advent of the BWC[4].

Since 1972, there have been several cases of suspected or actual use of biological weapons. The former Soviet Union and the government of Iraq were both signatories to BWC,

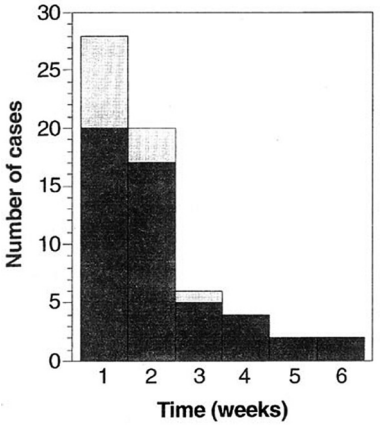
[3] Eitzen, EM., Jr; Takafuji, ET. *Historical overview of biological warfare.* [In:] Sidell FR, Takafuji ET, Franz DR., (editors), *Medical Aspects of Chemical and Biological Warfare.* Washington, DC: Office of the Surgeon General, Borden Institute, Walter Reed Army Medical Center; 1997. pp. 415–423. Available at http://www.pubmedcentral.gov/redirect3.cgi?&&reftype=extlink&artid=1200679&iid=121137&jid=302&&http://www.bordeninstitute.army.mil/cwbw/default_index.htm;

[4] Smithson A. E., *Biological Weapons: Can Fear Overwhelm Inaction?* [in:] The Washington Quarterly, Winter 2004-05

but despite this fact, biological warfare research continued in both countries. The Soviet Union continued a high-intensity program to develop and produce biological weapons through at least the early 1990s. The scope and size of this program were enormous. In the late 1980s and early 1990s, over 60,000 people were involved in the research, development, and production of biological weapons. Hundreds of tons of anthrax weapon formulation were stockpiled, along with dozens of tons of smallpox and plague. The total production capacity of all of the facilities involved was many hundreds of tons of various agents annually.

Soviet cheating on the BWC came to light when the U.S. government attributed the 1979 outbreak of anthrax at Sverdlovsk (now Yekaterinburg) to a covert weapons program. An incident appeared to be an accidental release of anthrax in aerosol form from Soviet Military Compound 19, a microbiology facility. Soviet officials attributed it to consumption of contaminated meat that was purchased on the black market[5]. However, epidemiological data showed that most victims worked or lived in a narrow zone extending from the military facility to the southern city limit (at least 66 people died out of 77). Additionally, many livestock died of anthrax in the same area, out to a distance of 50 km. The epidemic has occasioned intense international debate and speculation as to whether it was natural or accidental and, if accidental, whether it resulted from activities prohibited by the Biological Weapons Convention of 1972. In May 1992, Boris Yeltsin, then the president of Russia, admitted that the facility had been part of an offensive biological weapons program and that the epidemic was caused by an accidental release of anthrax spores.

Fig 6. *Time course of the epidemic: onsets of fatal cases by week*. The first week begins on 4 April 1979, the date of the first onset was recorded. Lighter shading represents cases for which the onset date is unknown and is estimated by subtracting 3 days from the date of death.



Source: *The Sverdlovsk Anthrax Outbreak of 1979*, UCLA. Department of Epidemiology [in:] http://www.ph.ucla.edu/epi/bioter/sverd/sverd_fig1.html

[5] Caudle, LC., III . *The biological warfare threat*. [In:] Sidell FR, Takafuji ET, Franz DR. (editors), *Medical Aspects of Chemical and Biological Warfare*. Washington, DC: Office of the Surgeon General, Borden Institute, Walter Reed Army Medical Center; 1997. pp. 451–466. Available at http://www.pubmedcentral.gov/redirect3.cgi?&&reftype=extlink&artid=1200679&iid=121137&jid=302&&http://www.bordeninstitute.army.mil/cwbw/default_index.htm;

After the incident in Sverdlovsk, the research was continued at a remote military facility in the isolated city of Stepnogorsk in Kazakhstan, producing an even more virulent strain of anthrax. In 1980, the former Soviet Union expanded its bioweapons research program and was eventually able to weaponize smallpox. This research was conducted at remote facilities in Siberia, and very little information is available about the extent, outcome and place of this research[6].

The Soviet Union was not the only country to violate the BWC. Other concerns still shadow the BWC, such as U.S. government concerns that Iran, North Korea and China maintain offensive biological weapons programs.

Despite BWC, the threat of biological warfare has actually increased in the last two decades, with a number of countries continuing to conduct research on the use of these agents as offensive weapons. Russia's low-paid biological weapons experts and other scientists earn salaries of about $100 a month. With scanty earnings and their institutes no longer receiving the generous subsidies of the Soviet era, scientists have been forced to look for trade and business opportunities. Abandonment their research or the country seems to be their only other alternative. Some of them, therefore, could be tempted to aid terrorists. Many former Soviet scientists, including biological weapons experts, have left Russia and emigrated to the United States and other Western countries.

The United States and Russia are also working on a program to curb the proliferation of biological material left over from the Soviet era.

The possibility of terrorist use of biological agents to threaten civilian populations is increasing concern.

The aims of terrorism do not require massive casualties for their fulfilment: death and physical damage are the means to an end, not an end in itself. The literature identifies the following aims of bioterrorism:

1. creating mass anxiety, fear and panic;
2. creating helplessness, hopelessness and demoralisation;
3. destroying our assumptions about personal security;
4. disruption of the infrastructure of a society, culture or city;
5. demonstrating the impotence of the authorities to protect the ordinary citizen and his/her environment.

'Conventional' terrorism made use of explosive and standard weaponry, but the authorities made access to such items more difficult and terrorists have had to seek methods of achieving an even higher level of threat. Although there are impediments to their use, including storage and dispersal, biological agents generally commend themselves to terrorists for at least following reasons:

1. it is relatively easy to obtain information about them (e.g. the accessibility of information on how to prepare biological weapons on the Internet);
2. compared to nuclear material or chemical agents, biological agents are relatively cheaper (the cost required to produce *mass casualties* during a biological attack has been estimated as approximately $1/km¸, in comparison to conventional weapon – ca. $2000, nuclear armaments – ca. $800 and chemical agents – $600) and easier

[6] Eitzen, EM., Jr; Takafuji, ET, *op. cit.*

to produce, and can be delivered without high technology or much scientific knowledge; only a small amount of the agent is required to initiate large-scale production (minimal resource allocation required to develop and maintain a BW program; the ease of concealing even large scale BW production and weaponization efforts);
3. although there have been considerable advances in the scientific understanding of the most lethal (Category A) biological agents such as Variola major (smallpox), Bacillus anthracis (anthrax) and Yersinia pestis (plague) and highly toxic (Category B) chemicals such as ricin toxin, there is much to be learned about their effects and how to combat; certain substances cause temporary disability and are not lethal (advances in biotechnology make mass production of BW agents easier to accomplish and may allow for development of agents that are more deadly and harder to detect and protect against, e.g. genetically manipulated organisms or antibiotic resistant organisms);
4. the effects of biological agents are commonly distant in time and place from the site of any initial incident and so perpetrators can attack without being identified and escape long before BW agents cause casualties; there is also a short window for effective intervention;
5. there is no clearly defined 'low point' from which survivors and their care-givers can look forward to respite and improvement;
6. viruses and microbes cannot be detected by traditional anti-terrorist detection systems;
7. the terrifying results of agents' implementation will exacerbate anxiety and cause panic;
8. relative to conventional weapon, the biological agents can be camouflaged, transported and introduced into the target area with the ease[7].

An agent to be considered for use in a biological warfare weapon must also have the capability to be effectively incorporated into a delivery system. Therefore, a biological weapon consists of both the agent and the means of delivery. Biological agents can be acquired, even by stealth, from research institutions or hospital clinical samples that have less stringent controls. A wide range of delivery systems for BW agents, such as spraying equipment which is available in the hardware stores and agricultural industry, can be purchased and used with few modifications. Low-technology aerosolization methods such as: agricultural crop-dusters; aerosol generators on small boats, cars or trucks; backpack sprayers; and even purse-size perfume atomizers suffice. Aerosolized dispersal of biological agents is the mode most likely to be used by terrorists and military groups. Long-range delivery systems such as missiles and aircraft are also becoming more widely available to Third World countries.

All of these advantages make BW agents attractive for state and nonstate actors alike. Due to these factors the threat from bioterrorism is particularly ominous.

There are however some disadvantages to using BW agents as weapons which include hazards to the user, dependence of biological agents on optimal weather conditions to result in effective dispersal and their possible inactivation by climatic conditions, e.g. solar

[7] Dany Shoham, *The new map of chemical and biological weapons in the Middle East* [in:] *NATIV online*, vol 4, June 2004.

irradiation. BW attacks would most likely occur late at night or early in the morning when agents would be less likely to undergo inactivation by ultraviolet radiation.

A disaster caused by the intentional release of biological agents would be very different from conventional military strikes, some natural disasters *(figure 1)* or attacks with other weapons of mass destruction (e.g. chemical or nuclear). When people are exposed to a pathogen such as smallpox or plague, they may not feel sick for some time and they may not be aware of their exposure, although they would be contagious. The incubation period may range from several hours to a few weeks, and consequently, an attack would not become obvious for a similar period. By that time modern transportation could have widely dispersed the pathogen and greatly expanded the population of victims, perhaps exponentially. Moreover, in their initial stages, many of the diseases delivered by biological weapons resemble common illnesses.

Table 3. *Disaster preparedness,* Source: Noji E. K., *Bioterrorism: a 'new' global environmental health threat* [in:] *Global Change & Human Health,* volume 2, no. I (2001).

Disaster preparedness		
	Bioterrorism	**natural disaster**
warning	not likely	common
location	not localized	localized
coordination	↑ law enforcement	civil defense
unusual pathogen	likely	not likely

Detection of a BW attack requires recognition of the clinical syndromes associated with various BW agents. Indications of possible BW agent attack include inter alia the following:

- Multiple disease entities in the same patients, indicating that mixed agents have been used in the attack;
- Disease entity that is unusual or that does not occur naturally in a given geographic area or combinations of unusual disease entities in the same patient;
- Large numbers of both military and civilian casualties when such populations inhabit the same area;
- Data suggesting a massive point-source outbreak;
- High morbidity and mortality rates relative to the number of personnel at risk;
- Illness limited to fairly localized or circumscribed geographic areas.

Biological weapon agents may be used against people, animals, or plants. Pathogens may kill or just incapacitate victims. Incapacitating agents may be more effective in battle by preventing a unit from carrying out its mission and overwhelming medical and evacuation assets. Agents with long incubation periods would appeal to terrorists, while those with shorter incubation times would be most effective in a tactical setting. Biological attacks against large populations would most likely be disseminated by aerosol. Such attacks could be also attempted by contaminating food and water supplies, although modern water purification and the dilution effects in large volumes of water would negate the effective-

ness of a water-borne attack[8]. More unusual methods of dispersion could include releasing agents in their natural arthropod vectors. Dissemination of BW agents may also occur by explosives (artillery, missiles, detonated bombs), however it is not very effective, since such agents tend to be inactivated by the blast. Contamination of municipal water supplies requires an unrealistically large amount of agent and introduction into the water after it passes through a regional treatment facility. Person-to-person transmission of several agents (especially plague and smallpox) could perpetuate an epidemic.

The potential spectrum of bioterrorism ranges from hoaxes and use of non–mass casualty agents by small groups or individuals to state-sponsored terrorism that employs classic biological warfare agents and can produce mass casualties. Such scenarios would present serious challenges for patient treatment and for prophylaxis of exposed persons. Furthermore, environmental contamination could pose continuing threats. The agents that could be used by terrorists are divided into three categories: A, B and C, depending on how easily they can be spread and the severity of illness or death they cause (table 4).

Table 4. *Critical biological agents in priority order*; source: Noji E. K., *Bioterrorism: a 'new' global environmental health threat* [in:] *Global Change & Human Health,* volume 2, no. I (2001).

Category A	**Category B**	**Category C**
High priority agents include organisms that pose a risk to national security because they can be disseminated or transmitted person-to--person; cause high mortality, with potential for major public health impact; might cause public panic and social disruption; and require special action for public health preparedness.	Second highest priority agents include those that are moderate easy to disseminate; cause moderate morbidity and low mortality; and require specific enhancements of diagnostic capacity and enhanced disease surveillance.	Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of availability; ease of production and dissemination; and potential for high morbidity and mortality and major health impact.

[8] Simon J.D., *Biological terrorism: Preparing to meet the threat* [In:] J Am Med Assoc 1997; 278: 428–430.

A Agents:	B Agents:	C Agents:
– Variola major (smallpox) – Bacillus antrhacis (anthrax) – Yersinia pestis (plague); - Clostridium botulinum toxin (botulism) – Francisella tularensis (tularemia); – Filoviruses, a) Ebola hemorrhagic fever; and b) Marburg hemorrhagic fever; and – Arenaviruses, a) Lassa (Lassa fever) b) Junin (Argentine hemorrhagic fever) and related viruses	– Coxiella burnetti (Q fever) – Brucella species (brucellosis); – Burkholderia mallei (glanders) – Alphaviruses a) Venezuelan encephalomyelitis, b) Eastern and western equine encephalomyelitis – Ricin toxin from Ricinus communis (castor beans); – Epsilon toxin of Clostridium perfringens; and – Staphylococcus enterotoxin B A subset of List B agents includes pathogens that are food or waterborne. These pathogens include but are not limited to: – Salmonella species, – Shigella dysenteriae, – Escherichia coli O157:H7 – Vibrio cholerae, and – Cryptosporidium parvum.	– Nipah virus, – antaviruses, – Tickborne hemorrhagic fever viruses – Tickborne encephalitis viruses, – Yellow fever, and – Multidrug-resistant tuberculosis.

Among biological agents that have been studied as potential weapons, anthrax may be the most likely choice for terrorists. It is not only easier to acquire than most but also quite lethal, killing 80 to 90 percent of all unvaccinated people who are not treated promptly. Furthermore, the anthrax spore is very durable, able to survive for decades in the soil or other areas protected from direct sunlight. However, anthrax does not spread from one victim to another and that limits its impact to those who inhale the aerosols.

Smallpox is an even bigger worry for some experts because of the global pandemic it could trigger. Unlike anthrax, smallpox is contagious, spreading from person to person through the air, and it kills about 30 percent of unvaccinated victims.

Fig. 7. *Man with smallpox (variola major);* source: CDC; http://www.bt.cdc.gov/agent/smallpox/smallpox-images/smallpox1.htm

Fig. 8. *This 15 year old girl developed cutaneous anthrax of the left lower eyelid*;

source: http://dermatlas.med.jhmi.edu/

Fig. 9. *Cutaneous anthrax on the finger of a veterinarian who contracted condition through animal exposure*

source: http://dermatlas.med.jhmi.edu/

Fig. 10. *A 45 year old Iranian farm worker developed a non-tender swelling of the upper lip followed overlying skin and formation of a black eschar.*

source: http://dermatlas.med.jhmi.edu/

Denying access to technology, safeguarding WMD facilities, and conducting inspections at borders and ports should be considered important tools to lower the likelihood of successful biological weapons acquisition and attack by terrorists. Yet, such tools will always be somewhat unreliable as long as a dedicated group of trained individuals can construct at least crude biological weapon. As there is no comprehensive structure for reviewing all of the research currently underway, scientists are being asked to exercise self-restraint and to establish codes of conduct consistent with norms against the proliferation of biological weapons. Although such codes do not provide active oversight of research, advocates claim that they would educate scientists on where to "draw the line" in their work, encourage them to report illegal activities and help them resist pressure from proliferators to make weapons.

The effects of an attack using viruses will be tremendous and they are for need to be acted upon quickly. 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. Many critical hours or even days could silently go by before we might know about the devastating effects of an attack using dangerous disease causing germ. Essential actions must be taken immediately after an attack to save lives. A great deal of responsibility has been placed on the health, medical, intelligence and military agencies to be prepared in the event of biological attack. The staff working at public health institutions, including legal medicine, must be involved in as a first responder when bioterrorism would happen. Both medical knowledge of bioterrorism and the preparedness with training under simulation should be required in advance. A different agency coordination and integration, e.g. law enforcement, is also required. As long as nations are acting individually and not collectively, proliferators will find loopholes. Proliferators will only be truly hindered if uniform, robust regulations are applied in thousands of laboratories and culture collections worldwide. Additionally, a complete approach to biosecurity would augment the licensing of facilities to receive and possess dangerous pathogens with the appropriate access and accounting controls, regularly updated select--agent lists, background assurances on laboratory personnel and emergency response plans and procedures[9].

The consequences of biological terrorism are liable to be tactical or strategic, acute or chronic, and/or physical or psychological. A bioterrorist attack will undoubtedly raise many important political, moral, legal and ethical issues involving the authorities of state, civil liberties and liability in the event mass vaccination is necessary. An effort to identify and better understand such issues is important.

What is crucial, is the international community's political will to make the norm against biological weapons and its principal instruments more than empty constructs. The costs of failing to meet the challenge could be astronomical as the passivity makes all nations equal prey to proliferators who could instigate biological disaster.

Biological Warfare and Bioterrorism

Summary

This article is focused on the possibilities of using biological warfare in terrorist operations. The author presents a development of research on biological warfare in last 50 years, advancing a thesis that biological warfare becomes one of the most important threats of the contemporary world. Free access to, and low costs of production of biological warfare create unlimited possibilities of using biological warfare. Therefore, bioterrorism constitutes one of the biggest, potential threats of the contemporary world.

[9] Jonathan B. Tucker, *Preventing the Misuse of Pathogens: The Need for Global Biosecurity Standards* [In:] *Arms Control Today*, June 2003, pp. 3–10.