

## Countermeasures to Bioterrorism Acts

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Biological agents have been used for centuries in the history of mankind. Currently, biotechnology is considered one of the advanced and emerging technologies of the twenty-first century. Countering bioterrorism acts at the national and international level implies organizing the effective prevention and investigation of illegal use of biological agents for criminal purposes. Appearance of the opportunity of biological terrorism, including in our country, is a serious threat, because today the population and public services are ready neither to fully adequately respond to such terrorist attacks, nor to take timely and effective measures to eliminate the consequences of such terrorist attacks. Improvement of methods of prevention, detection and proof of terrorist attacks committed with the use of biotechnology is one of the urgent problems of law enforcement today. This is due to the lack of the scientific study of the problem, the lack of clear ideas about strategy and ideology of the struggle, as well as legal, criminological, forensic and search concepts and relevant scientific guidance on the identification, detection, investigation and prevention of such criminal activity. Collection of admissible evidence in the investigation may be difficult because of its specificity. Collection, storage, examination of evidence must be carried out in such a way that the evidence would be admissible in a criminal prosecution, i.e. the approach of affordability, reliability and relevance of evidence should be provided. There are real challenges in the investigation of bioterrorism acts. This article describes certain problems in this area and suggests ways to address them through the improvement of information security, the organization of special training courses and so on.

**Key words:** Biotechnology, terrorism, countermeasure, bioterrorism, biosystem.

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Biotechnology is considered one of the advanced and emerging technologies of the twenty-first century. This term usually refers to a set of methods, processes and tools that use biosystems, living organisms or derivatives thereof to manufacture, produce or change the properties of the products or goods for a specific use. The main applications of biotechnology and

implementation of their results are healthcare and pharmaceutical industry, industrial production, as well as agricultural crops, livestock, veterinary medicines.

An integral feature of biotechnology is advanced scientific research based on the latest achievements of science and technology and the close relationship between innovation and economic efficiency. In the most general sense, biotechnology can be defined as the sharing of scientific biology and new technological research that is useful and beneficial in various areas of

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human activity. Medical and pharmaceutical industry and the health care industry in general are the most important areas of modern biotechnology: the treatment of complex diseases, surgery, preventive medicine, early diagnosis of genetic predispositions to disease, systemic and comprehensive examination, diagnosis of diseases, development and creation of highly effective medicines, biological additives, etc.

Advances in molecular and genomic research, new technological methods of production, processing and creation of pharmaceutical drugs and microbiological objects are becoming more widely used and offer a great potential for improving the health care, environmental and economic areas of their implementation. The role and importance of the progressive development of biomedical technologies cannot be overstated. Scientists have developed several generations of vaccines, diagnostic and therapeutic agents against the most dangerous infections that have contributed to a virtual elimination or significant reduction of diseases such as smallpox, poliomyelitis, diphtheria, tetanus, pertussis, etc.

#### **Methodology**

The successes achieved in the biological sciences are, of course, of a great benefit to mankind. However, they may be of great danger if used for abusive purposes.

Rapidly developing new technologies can be used to the detriment of the human, either intentionally or unintentionally. In the global medical practice, there are cases where the return of a known infectious agent to the exposed population has led to very serious consequences.

For example, in 2004, researchers in Madison, Wisconsin, the United States, reconstructed a 1918 influenza virus using the reverse genetic engineering technology. Experts believe that the technology used to recover deadly viruses can be relatively easy to use in the future, so biologists will be able to copy those from the past. The same engineering methods used to develop vaccines against viruses can be used to modify the virus in order to make it more virulent: new methods of the analysis and change of the genetic material of an organism, which have created revolution in the biotechnology, can also contribute to the development of biological weapons

technology. Today, many countries have the technical capacity to produce large numbers of pathogenic microorganisms<sup>1</sup>.

It is known that biological weapons were used in the history of mankind much earlier than firearms, chemical, nuclear and other weapons. With the development of scientific and technological progress and possibilities of biotechnology, the danger and the consequences of its use multiply. According to Ronald Noble (Interpol), "bioterrorism is a crime, which is useless to fight after the fact. The harm done is too great. Millions, hundreds of thousands of people could die just because bioterrorism prevention was not in our list of priorities"<sup>2</sup>.

The idea of the need to prevent any kind of terrorism in our country permeates the work of the President N.A. Nazarbayev "A critical decade": "the adoption of preventive measures against the threat of terrorism today is one of the priorities in the national security of the Republic of Kazakhstan. ... waiting for terrorism and its practical acts to try and find a niche in the territory of Kazakhstan is at least absurd. Preventive action should be translated into appropriate responses. At present, the areas of high terrorist activity in the world are in relatively close proximity to Kazakhstan, and therefore the emergence of terrorism directly on its territory cannot be ruled out"<sup>3</sup>.

According to the analysis of the available literature, today there is no official definition of bioterrorism as a form of terrorism in general in our country. In summary, it is understood as the illegal use of viruses, bacteria, fungi, toxins or other pathogenic materials against the government, civilian population, livestock, crops, etc.

#### **Outcomes**

For harmonization and consistency of the terminology, the following definitions are suggested:

biological terrorism – the use of the dangerous biological agents in socially dangerous acts (action/inaction) to damage life and health of humans in order to achieve the political and material goals;

sources of biological hazards – a set of natural and manmade biological factors that through the dissemination (intentional/unintentional) of hazardous biological agents are capable of causing significant harm to the health

of humans, animals or cause their death, or cause damage to society and the economy; biological agents – pathogenic microorganisms, toxins and parasitic organisms that cause diseases of humans, animals, plants, destruction of materials, the sharp deterioration in the quality of the environment, which can also be used as damaging agents in biological weapons and bioterrorism weapons.

A bioterrorist attack may be targeted at water, food, soil, air, animals and humans. As for the intentional unlawful use of pathogens against the humans, there is a significant number of publications on such acts in the subway, sports arenas, train stations or other public places, which led to the death, mental suffering and economic loss. In addition, the safety of the plant and animal resources is of paramount importance for the social and economic condition of the country. Thus, to date, bioterrorism poses a special danger and is a matter of grave concern to the international community. The increased possibility of bioterrorism strongly dictates the need to improve the system of biological safety of the state.

Wide opportunities of the modern rapidly developing biotechnology, which is the basis of modern biological terrorism, contribute to the increasing alarm among the population. Possibility of use of the biological agents for political, ideological and other influence on the public authorities, the specific organizations and structures and individuals creates a climate of general concern and disbelief in the strength and ability of appropriate structures to counteract and prevent such acts, creates a sense of insecurity.

Microorganisms of a dual use, which can be used for both positive (peace) and destructive purposes, are of a particular danger. Traditional categories of selection of the agents are important, and they are now combined with the increasing capabilities of the rapidly evolving technologies. According to many experts, it is naive to think that the extraordinary growth in the field of biology and related technologies cannot also be used for nefarious purposes; in addition, there are a number of biologically active organic compounds called bioregulators, which are not included in the selection list of the agents, but are the potentially toxic compounds. Combined with improved methods of distribution, these bioregulators can cause serious damage, in particular, to the nervous,

endocrine and immune systems of humans [1, p.15].

## DISCUSSION

One of the areas of modern biotechnology is genetic engineering. Genetic engineering makes it possible to combine different types of genes by altering their genetic codes and creating new organisms. Obviously, this raises many social and ethical concerns, as well as concerns about the impact of genetically modified or recreated organisms on human and animal health, environment and agricultural practices. Lacking the reliable data on the genetic diversity of the strains constructed and how they evolve, it is difficult to rely on the creation of effective countermeasures, i.e. it is almost impossible to feel protected under such circumstances. Consequently, the biological weapon is potentially the most dangerous weapon, and no state has the right to feel safe when it comes to transnational biological threats.

Some scientists argue that the genetically modified products can distribute, mutate and migrate, and they can't be recognized after their release. The scientific community began to show concern about the use of scientific discoveries for negative purposes, the increase in the possibility of accidental release of pathogens and genetically modified objects, as well as the openness of scientific information [1, p.31].

In this context, of a particular importance is the question of what kind of data (information) should not be accessible to the general public, what research should be carried out in different levels of protected laboratories, and what measures should be taken to ensure the safety of biological agents and information. On the other hand, the public must possess a certain amount of information in terms of awareness and be able to respond adequately in the event of misuse of biotechnology and materials, be skilled in personal protection. The population should be informed about the threats and consequences of use of biological weapons, methods and means of self-defense, as well as the possibilities of the adequate response from the public authorities in case of an emergency. This task will require the attention and cooperation of the international community in order to ensure control of research and dissemination of information, as well as educating the scientific

community about the potential dangers, as well as biosafety and biosecurity. The 1972 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction establishes certain provisions for the exchange of such information at the international level.

For centuries, there have been many cases of the use of microbial agents as biological weapons in order to commit murder or injure humans. Most of these acts were committed as a result of the simplicity and easy availability of specific microbial agents with high infectious potential. Nevertheless, even today, being armed with the latest technological advances, it remains extremely difficult to investigate and confirm the origin of the strain and to identify the person and/or the motives of such crimes. An example of this is a large-scale investigation begun in 2001 upon bioterrorism with the anthrax in the United States<sup>4</sup>.

Appearance of the opportunity of biological terrorism, including in our country, is a serious threat, because today the population and public services are ready neither to fully adequately respond to such terrorist attacks, nor to take timely and effective measures to eliminate the consequences of such terrorist attacks. Improvement of methods of prevention, detection and proof of terrorist attacks committed with the use of biotechnology is one of the urgent problems of law enforcement today. This is due to the lack of the scientific study of the problem, the lack of clear ideas about strategy and ideology of the struggle, as well as legal, criminological, forensic and search concepts and relevant scientific guidance on the identification, detection, investigation and prevention of such criminal activity.

Obstacles for the effective investigation and prosecution of such facts are quite numerous. Obligation to investigate such cases is clear from the ethical and legal point of view, but the implementation of this obligation can be very difficult for international organizations and government entities. Firstly, countries or public entities may be reluctant to declare outbreaks or notify the appropriate officials, despite the "requirements for the country to inform the relevant international organizations ... about any disease outbreaks"<sup>5</sup>. This reluctance may be due to the possible economic consequences of the disease,

such as the impact on the economy, tourism and trade. Even if a country has no objection to report outbreaks of disease in its territory, there may be difficulties associated with the diagnosis of the disease broke out<sup>6</sup>.

While public health care should be able to identify the infectious agent, properly provide the appropriate therapy for affected people and carry out an epidemiological study, the sanitary-epidemiological services must determine which anti-epidemic measures should be taken and undertake a range of activities from forensic point of view; the area affected by the biological impact should be treated as a crime scene, and all the necessary actions should be taken there. First of all, it is necessary to ensure access restriction, i.e. cordon off the affected area and allow access to it only through the designated protected checkpoints, identify persons (entities), who are allowed to enter and conduct the appropriate action. The borders of the contaminated area should be defined; however, these boundaries may be variable – for example, in accordance with changing circumstances, discovery of new fact or weather conditions (change in wind direction, etc.).

## CONCLUSION

The great difficulty is to establish the fact of committing an act of bioterrorism, which is likely to be difficult to detect early – this leads to sudden and unexplained appearance of single or mass cases of communicable infectious diseases among the population. In addition, it is difficult to determine whether the epidemic or pandemic disease is artificial or natural.

An important and beneficial for terrorists could be the fact that biological weapons affect relatively slowly, giving the criminals plenty of time and opportunity to escape.

Once the outbreak of the disease is recorded, the victims of the outbreaks and biological agents that cause flare-ups must be identified. As a rule, the first who come into contact with victims are health care providers. Their main task is to provide medical care to the victim while maintaining a certain level of privacy and confidentiality of the patient. Although these principles are important in the treatment, they may complicate the process of detecting and responding

to the deliberate outbreak. These complications are associated with the idea that the priority of the physician is the patient's treatment, not the obligation to collect and preserve evidence. In addition, medical personnel are reluctant to share their materials with investigators. Doctors and investigators prefer to conduct a parallel investigation, not sharing critical information that could lead to better outcomes for both parties<sup>7</sup>.

Collection of admissible evidence in the investigation may be difficult because of its specificity. Collection, storage, examination of evidence must be carried out in such a way that the evidence would be admissible in a criminal prosecution, i.e. the approach of affordability, reliability and relevance of evidence should be provided. For example, to meet the procedural requirements, the samples must be labelled with the time and date of collection, specifying the person who collected the evidence; if the samples are sent to the laboratory for analysis, they must be packaged appropriately and adequately protected against unauthorized access, loss, falsification or risks of pollution, etc. During a biological incident, health care providers can be the first to collect evidence, but due to lacking the experience in gathering evidence and/or being unaware that it can be used in the investigation of an act of bioterrorism (incident) or sent for forensic examination, they may lead to contamination of the collected evidence. In addition, health care providers may send evidence to laboratories that do not comply with the procedural requirements and in violation of the rules of transportation, making further evidence useless for the purpose of prosecution. Violation of such requirements increases the chance of errors.

Even after meticulous investigation, the discovered evidence may be not admissible in court if it is collected by methods in violation of procedural rules.

Thus, the collection and storage of evidence must be carried out with extreme caution, because it can be any objects contaminated by biological agents, including clothing of those who were in the lesion. Physical evidence must be placed in barrier bags, sealed, and carry the appropriate label indicating the specific location from which each item was withdrawn; time when the object was received and from whom; time of each

transmission of the object; storage facility.

Once the victims and biological agents that caused the outbreak are identified, it is necessary to determine whether this outbreak was a deliberate act or natural. The World Health Organization says that there are many reasons that make difficult to determine whether the event was intentional or natural: "the problem may be caused by the accessibility and widespread availability of dual-use technologies, diseases arising and reappearing in relation to climate change and rapid growth of population or the consequences of terrorist attacks"<sup>8</sup>.

The WHO recommends that countries follow the recommendations developed to determine whether the outbreak was an intentional event. The facts related to its beginning must be used, and it must be found out in a survey whether there is a suspicion of deliberate use of biological agents. At the same time, it is necessary to consider alternative theories that could explain why there was an outbreak of the disease. During the examination of those affected by the outbreak, it should be determined whether the victims have any special features – in particular, whether it is an outbreak among the people who participated in the mass action [8]. In cases of bioterrorism, the persons can be identified who suggest what could cause the outbreak. Although it seems to simplify the process of definition, it may actually complicate it. Perhaps, the outbreak was actually caused by natural phenomena, but the terrorist group claims that it caused the event as an act of terrorism. In this case, the details associated with the beginning must be carefully examined in order to determine whether the terrorist group had capacity to carry out such attacks [5, p.22].

Thus, even at the beginning of the first steps, the investigation of such events can be extremely difficult. A further task of the investigation is to establish the person(s) who have committed a biological attack. This can be accomplished by determining the form of the pathogen or toxin used. Some pathogens or toxins such as anthrax have certain properties that can only be created in a laboratory or by persons with special training [9]. It is necessary to establish whether the biological weapons (biological agents) were purchased (and how), stolen or somehow obtained from a person or place that has the ability

to create a biological agent like the one that was used.

Investigations can take an indefinite amount of time, since the detection, fixation, removal and storage of microbial evidence is a specific and painstaking task that requires a skilled approach. The evidence collected must be delivered to the laboratory, which is capable of testing the certain types of microbial agents.

Problems associated with the investigation of bioterrorism are illustrated by the investigation of mailing the envelopes with anthrax. Since the beginning of the attacks through the letters with anthrax, the investigation was complicated by the fact that the doctors did not recognize that the victims were infected with anthrax<sup>9</sup>. Determination that anthrax was a deliberate event was evident, as it was sent with a letter saying that the outbreak was focused, but the identification of the perpetrators of the attacks was extremely difficult [9, p.81].

Originally basing on the letters of the text, it was suggested that the attack could be organized by a terrorist group. However, the investigators have expressed serious doubts that a terrorist group might have a scientific potential for the production of anthrax – in particular, the one used in the attacks [9, p.75]. The most likely culprit profile began to focus on the individual scientists who had access to knowledge and access to anthrax used in 2001.

The investigation in this case lasted for almost a decade, during which hundreds of thousands of hours of investigation were spent on the case, and it was officially closed in 2010. After a decade of investigation, despite all the efforts and extensive research, the perpetrators have not been conclusively identified [4, p.42].

This shows how complex the investigations of crimes related to biological agents can be. In the trial, it may be impossible to accept the results of the investigation as admissible evidence<sup>10</sup>.

Apart from the fact that the investigation may take a long time, the evidence may be subject to various changes or deteriorate due to the environment or over time. Sample collection and analysis is invaluable in the case of biological agents, which generally rapidly degrade in the environment and cannot be detected after several

days or weeks.

We should also mention the importance of the means and methods used. For the purposes of international cooperation in the field of forensic activities, the scientific and technological means, methods and techniques used in the investigation should be standardized and certified in accordance with international standards.

Forensics is particularly important in the investigation of terrorist attacks. Forensics is a source of objective information obtained on the basis of scientific expertise. According to most authors, forensics is the most important form of attracting expertise in the proceedings resulting in the disposal of new information for the investigation and the court, which has relevant probative value and cannot be obtained by other proceedings.

With regard to the specific expertise, its subject is the expert problem to be solved by the expert in the course and upon the results of the study, based on an appropriate amount of scientific expertise using the means and methods at the disposal. It should be noted that the capacities of expertise are growing steadily, there are new kinds of them, and a scope of issues being solved during the expert study is constantly expanding.

The microbiological examination becomes very important in the investigation of the acts using biological agents. The judicial system allows the use of highly qualified scientific research in the form of various types of expertise, but the use of microbial forensics is a relatively new area<sup>10,11</sup>. This is due to the fact that some key differences and microbial properties of objects determine the specificity of this type of research. The microbiological examination exists at the intersection of the sciences of criminology and microbiology, and taking into account the increasing role of this type of research and the improvement of the methods and tools, the allocation of further separate branch of scientific knowledge – the forensic microbiology – can be assumed.

The difficulties of the investigation and prosecution of acts of bioterrorism are compounded by high cost of mistakes. Civil liberties, as a rule, are always limited, because many of the techniques used by public health care to combat infectious diseases, such as quarantine,

may violate the constitutionally protected rights and freedoms of citizens<sup>12,13</sup>. In addition, investigative, expert and judicial errors can cause serious damage to the personal and professional reputation of the suspect involved in the proceedings, i.e. a number of ethical issues arise<sup>14-17</sup>.

Investigation of crimes involving the use of biological agents may be subject to many other problems, which complicates the need for fighting and preventing such crimes. For the purposes of their effective investigation and prevention, the experiences of other countries in this area should be studied, and appropriate conclusions should be made, which will help avoid many problems.

First of all, an adequate exchange of information is very important during the primary response in the event of a biological attack, taken both by health care providers and the investigating authorities. Health care providers should report the specific symptoms observed to the appropriate health organization as soon as possible in order to determine the possible causes of infection or outbreak. As you know, one of the most important factors determining the success and effectiveness of the crime solution is the level of its information security.

Special training of persons involved in the investigation, in our opinion, will help solve some of the problems. In particular, this applies to forensic experts. First of all, it is necessary to develop specific regulations for handling biological agents for persons with no expertise in this area, which would contain the minimum requirements for safety and personal protection. In addition, the persons involved in the inspection of the scene should be trained how to collect and store such evidence. For these purposes, the specific rules for the collection of specific microbial objects should be developed, and investigators, forensic experts, health care providers should be trained with explanation of why the compliance with the rules of evidence gathering and transportation are important, and how different types of biological evidence should be retained for further use in the proceedings. Accordingly, there is the need to establish and maintain a special kind of accounting (single database). In addition, methods for testing the microbial objects should be standardized, so that the data provided by them would correspond

to the standards of their admissibility in court.

Thus, the difficulties of investigating crimes committed with the use of biological objects are numerous: challenges arise from the first steps in determining whether an outbreak was an intentional event or a natural phenomenon; the process of establishing the perpetrators can last for a long time; collection, storage and examination of evidence, due to its specificity, require a special approach, etc. However, the quality of the investigation can be ensured by measures such as improvements in communication, technology, the creation of training programs with the simulation of situations caused by acts of bioterrorism, development of a system of measures to act in emergency situations and the organization of special training courses in this area. In addition, it is necessary to set up a national unified automated system of monitoring and control of biological environment, as well as activation of international cooperation in the field of biological safety, harmonization of Kazakhstan's legislation on biological safety with the international counterparts.

International cooperation in this field plays an invaluable role, because the fight against terrorism cannot and should not end at the borders of states, otherwise it may be inconclusive.

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