

SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENTS RELEVANT TO THE BIOLOGICAL WEAPONS CONVENTION

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(UNOFFICIAL TRANSLATION)

1. Systematic analysis of foreign and domestic publications, as well as data on fundamental and applied research, suggests current efforts focus intensively on creating new Medical Means of Protection (MMP) against biological threats. It is recognised and universally acknowledged that these studies can be dual-use and can be used to create Biological Damaging Agents (BDA), including those with unusual properties. Conducting similar work may not formally contravene the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (BWC) and can always be justified as in the interest of protecting the health of citizens, and falling under the sovereign right to public health.
2. Frameworks for both public health and protection from bioterrorism are being expanded, including through the creation of new scientific centres for studying microorganisms and toxins. Special focus has been placed on laboratories with high biosafety levels. Improving laboratory capacity for investigating agents of dangerous infectious diseases will make it possible to create networks of specialized regional centres with maximum biosafety levels. This, objectively, cannot do otherwise than cause apprehension under the scope of the BWC.
3. At the same time, the systematic development of biotechnology has led to an increase in the effectiveness of MMP and personal protective equipment, revealing new possibilities for obtaining agents which could be used in Biological Weapons (BW) and creating new strains of highly pathogenic microorganisms without the use of a BL3 or BL4 laboratory. This considerably hampers possibilities for controlling the activities of both individual actors and entire states.
4. At present, experts in the BW field have voiced concerns that that scientific methods, studies and research in the fields of genetic engineering, biotechnology, toxicology, molecular biology and other related sciences, make it possible to create a new generation of BW [1].
5. In this case, scientific and technological developments could be used to:
 - (i) Increase the virulence and antibiotic resistance of pathogenic agents;
 - (ii) Enhance non transmissible agents so that they can be spread by airborne transmission (for example, designed using pathological samples containing the highly infectious and pathogenic virus which caused the 1918 influenza pandemic, etiological agent of "Spanish Flu");
 - (iii) Create other organisms or biological products capable of acting on humans and ecosystems (parasites, insect-pests, disease vectors, etc.).
6. One development often quoted as having a potential which could be misused to create new BPA, is the "Human Genome Project". The project ran from the middle of the 1980s until

the end of the 20th Century and did not fall under the scope of the BWC. Prior to the publication of the first draft of the human genome only 483 drug targets had been identified and developed. Now it is known that many of the 50000 genes which make up the human genome, can be used to identify targets for next generation, specific BW [2,3]. Elucidation of the precise structure of human DNA, and a basic understanding of the functioning and regulation of genes, makes it objectively possible to identify markers which determine the racial and ethnic differences between people. This may provide an opportunity to develop BDA which clandestinely target specific groups of people [genetically or ethnically targeted BW].

7. Subsequently, serious concerns have been caused by the project, created by the US National Geographical Society, IBM and the US National Institute of the Study of the Human Genome, to study the Y chromosomes and mitochondrial DNA in 100,000 people from different regions [4]. The results obtained from the project suggest the data generated could be used for developing methods to selectively disturb cellular respiration and energy exchange, sexual reproduction and a number of other important functions connected with Y with the chromosome (for example, the coagulability of the blood). Similar information could become the basis for developing a new type of the weapon of mass destruction - "ethnic weapons".

8. Statements about the possibility of designing "ethnic weapons" have a firm scientific base. Data analysis of the human genome showed that it contains hundreds, and even thousands, of sequences which could serve as targets for the selective biological weapons. The studies, carry out within the framework of project "Sunshine" demonstrated, that differences in frequency of genetic markers between races can be very high [5]; one polymorphous fragments of genome (code number TSC0493622) was demonstrated to have a ratio of 0%:94% between two populations. This fragment occurred in 94% in the Afro-American population, whilst it was not generally present amongst Asians [6]. Another example of differences in the frequency of polymorphisms can be found in the gene encoding the receptor for the protein melanokortina-y. This polymorphism was found in 70% of Eastern and South-Eastern Asians whilst not generally prevalent in Africans [7].

9. Recently a group of Taiwanese researchers discovered that Severe Acute Respiratory Syndrome (SARS) can be associated with specific genetic profiles. This serves as additional proof that infectious diseases can have the genetic or ethnic boundaries [8].

10. In the last decade, science and technology underwent rapid development, due to the advent of nanotechnology. Like any critical technology, the study of the properties of nanostructures can be considered dual-use. Studies of the mechanisms of the action of nanoparticles on living cells and material, show that the non-toxic substances and material, when utilized in the form of nanoparticles, can cause irreversible consequences in mammals, up to and including a lethal outcome [9,10].

11. Studies of penetration and transportation of nanoparticles in blood and lymphatic capillaries established that the gold nanoparticles, encapsulated by albumins, were capable of passing through the walls of alveolar capillaries into the intercellular space. This establishes that nanoparticles can effectively cross the specialized biological barriers of cells.

12. Thus, these interactions between nanoparticles and living cells and material may provide for the synthesis of novel substances, which possess greater toxicity and irreversibility of action

than any identified previously. The ability of nanoparticles to easily pass through human biological barriers when combined with qualitatively new toxicological properties could lead to the creation of a new class of the physiologically active materials, which could become the basis for developing a new type of biological weapon relevant to the BWC.

13. Studies which can be used for creating the non-lethal biological weapons (NLBW) should be dealt with separately.

14. One avenue of development which might relate to the creation NLBW are studies in the field of allergology. Taking into account the possibility of the aerosol propagation of allergens, the minimum values of effective doses, and also the complexity of diagnostics and treatment, the dangers associated with developments in this field are particularly significant. Analysis of open scientific publications testifies as to the successful production of genetically engineered allergens. Recombinant allergens have included elements from the pollen of plants and epidermal and microbial allergens [11]. One should assume that the creation of highly productive recombinant strains will make it possible to produce large volumes of allergens in short periods of time.

15. Physiologically Active Materials (PAM), or bioregulators, can be also considered as a basis for creating next-generation BW agents because of their high biological activity. In micro-doses they produce changes in the most important physiological functions of humans. Experimental studies in mammals have shown that PAM can disturb cardiovascular function, respiratory systems, and immunity. Published literature describes studies directed primarily at explaining interactions in different receptor systems and determining new targets connected with the disturbance of physiological concentrations of endogenous PAM [12,13]. For example, studies to synthesise short, highly active peptides which interfere with mammalian cardiovascular systems [14]. Another example of endogenous PAM are *tsito-kiny*, which can not only act as destruction factors for infected or modified cells, but can also possibly activate the growth of pathogenic bacteria [15]. Such PAM can be aimed specifically at the cells which ensure the first line of antiviral and anti-tumorogenic protection [16].

16. Another avenue of development, which might, to the certain degree, be associated with the problem of NLBW, is the potential use for military purposes of agents causing slow-onset infections – such as prions. Desirable characteristics of these agents include: the high environmental stability of these agents; their potential involvement in epizootic diseases in numerous species of vertebrates, including man; and the progression of related diseases without prompting immune response [17].

17. In relation to the defences inherent in humans, it should be noted that there might be a new capability in the development of BW, namely the development of biological agents capable of pathologically acting directly on the genomes of people and animals without an infectious process. Pathology symptoms of such agents would have a lifelong nature, resemble hereditary diseases and be inherited from generation to generation, decreasing the viability of that hereditary line.

Designing genome-targeting BDA is connected with the development of Gene Therapy. This technology introduces new genetic material into the cells of individuals with the specific target receptors or inhibits the expression of endogenous genes. The scientific literature contains numerous reports of the application of this technology to influence the genomes of animals and plants. Among such studies there are works, in which lethal and mutilating effects are described [18,19]. One should note again that the emergent pathology would not be infectious complicating diagnostics, preventive maintenance and treatment.

18. Practically all of the developments connected to agents of infectious disease, as enumerated above, can be realized not only for human pathogens, but also for animal and plant pathogens. Over the last several years, outbreaks of infectious diseases in animals have regularly (in one way or another) been connected with terrorist activities or offensive biological weapons programmes. Examples include: the outbreak of bird influenza in 2004 and 2005, the 2003 epidemic of atypical pneumonia, and the 2001 outbreak of foot-and-mouth disease.

19. The possibility that scientific developments could be used to create novel anti-animal or anti-plant BW is unjustifiable and should be prevented. As history illustrates, the social and economic consequences of outbreaks of animal and plant diseases are significant and, more importantly, can be forecast. The outbreak of foot-and-mouth disease in 2001 in Great Britain damaged the economy of that country. According to approximate calculations, the outbreak cost \$30 billion [20], and resulted in the destruction of more than 6.5 million animals. This caused a rapid economic decrease, a reduction in tourism, and a significant loss of exports (the market share was adopted by other states and commercial companies, including the pharmaceutical industry).

20. This establishes that complex epidemiological situations in certain regions, including the appearance of cases of infectious disease, could be in the interest of a number of States (for example, those that rely heavily on the export of food goods and work forces) and important commercial enterprises (for example, companies producing foodstuffs, prophylactics and medicines). These financial motivations create an incentive for diverting industrial capacity for use for prohibited purposes. Thus, the danger of novel anti-animal and anti-plant BW being developed is significantly high.

21. This analysis of the open scientific literature makes it possible to conclude that the application of existing scientific studies, if used for malign purposes, offers considerable potential for conducting research and development directed toward obtaining next-generation biological weapons in contravention of the BWC.

22. As a result, regulations (developed as international understandings) to limit access to scientific information which can be used directly to create novel biological weapons is an important approach to address the threat of BW.

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