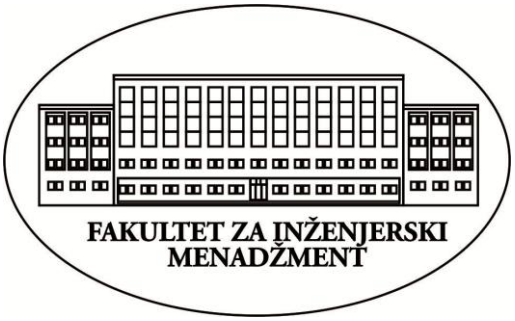

"UNION - NIKOLA TESLA" UNIVERSITY IN BELGRADE

BELGRADE SCHOOL OF ENGINEERING MANAGEMENT

Mubarak Saeed Ahmed Burshaid Al-Dhaheri

MEETING THE CHALLENGES OF BIOLOGICAL THREATS: STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

Doctoral Thesis

Belgrade, 2022

Универзитет "УНИОН - Никола Тесла"
Факултет за инжењерски менаџмент

Mubarak Saeed Ahmed Burshaid Al-Dhaheri

MEETING THE CHALLENGES OF BIOLOGICAL THREATS: STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

ДОКТОРСКА ДИСЕРТАЦИЈА

Београд, 2022. године

I express my deep gratitude to everyone who encouraged and supported me on the way to study this demanding and important field for human welfare and international security to which I am selflessly committed

Sincerely,

Mubarak Saeed Ahmed Burshaid Al-Dhaheri

"UNION - NIKOLA TESLA" UNIVERSITY
BELGRADE SCHOOL *of* ENGINEERING MANAGEMENT
Bul. vojvode Mišića 43, Belgrade

MEETING THE CHALLENGES OF BIOLOGICAL THREATS:STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

PhD THESIS

Mentor:	Prof. Dr. Elizabeta Ristanović University of Defence
President of panel	Prof. Dr. Vladimir Tomašević, FRSA "Union - Nikola Tesla" University
Members of panel	Emeritus Darko Tanasković, PhD UN University for Peace
	Prof. Dr. Branko Krga "Union - Nikola Tesla" University
	Prof. Dr. Srđan Tomić "Union - Nikola Tesla" University
	Prof. Dr. Dušan Proroković, Institute of International Politics and Economics, Belgrade
Viva voce date	17th of December, 2022.

Универзитет "УНИОН - Никола Тесла"
Факултет за инжењерски менаџмент
Булевар војводе Мишића 43, Београд

MEETING THE CHALLENGES OF BIOLOGICAL THREATS:STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

ДОКТОРСКА ДИСЕРТАЦИЈА

Ментор:	Проф. др Елизабета Ристановић Универзитет Одбране
Председник комисије:	Проф. др Владимир Томашевић, *FRSA* Универзитет "УНИОН - Никола Тесла"
Чланови комисије:	Професор Емеритус Дарко Танасковић Универзитет за мир Уједињених Нација
	Проф. др Бранко Крга Универзитет "УНИОН - Никола Тесла"
	Проф. др Срђан Томић Универзитет "УНИОН - Никола Тесла"
	Проф. др Душан Пророковић, Институт за међународну политику и привреду, Београд

Датум одбране дисертације, 17. децембар, 2022. године

Attachment N° 1

Declaration of authorship

The undersigned Mubarak Saeed Ahmed Burshaid Al-Dhaheri

Contract N° 1A/2019 signed on October 1, 2019

I hereby declare

That the doctoral dissertation entitled

MEETING THE CHALLENGES OF BIOLOGICAL THREATS: STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

- is the result of my own research work,
- that the proposed dissertation was, neither as a whole or in parts, submitted for obtaining any degree of other higher education institutions,
- that the results are correctly stated and
- that I have not violated the copyrights nor have used other persons' intellectual property.

PhD student signature

Belgrade, December 17, 2022

Attachment N° 2

Declaration on the identity of the printed and electronic version of the doctoral thesis

Name and surname of the author: Mubarak Saeed Ahmed Burshaid Al-Dhaheri

Contract N° 1A/2019, signed on October 1, 2019

Study program "Engineering and management of strategic security systems"

The thesis title: MEETING THE CHALLENGES OF BIOLOGICAL THREATS: STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

Mentor: Prof. Dr. Elizabeta Ristanović

Supervisors signature

I hereby declare that the printed version of my doctoral thesis is identical to the electronic version that I submitted to the **University Library of "Union-Nikola Tesla" University in Belgrade.**

I allow the publication of my personal information related to obtaining the academic title of Doctor of Science, such as name and surname, year and place of birth and the date of thesis defence.

This personal information may be published in the electronic catalogue and in the publications of the University "Union-Nikola Tesla" in Belgrade.

PhD student signature

Belgrade, December 17, 2022

Attachment N° 3

Statement of use

I authorize the Library of the University "Union-Nikola Tesla" to enter my doctoral dissertation in the Digital Repository of the University under the title of:

MEETING THE CHALLENGES OF BIOLOGICAL THREATS: STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

which is the result of my own work.

I submitted the dissertation with all its attachments in an electronic form suitable for permanent archiving.

My doctoral dissertation stored in the Digital Repository of the University "Union-Nikola Tesla" can be used by anyone who respects the provisions contained in the selected type of Creative Commons' license that I opted for.

1. Authorship
2. Authorship - non-commercial
3. Authorship - non-commercial - no adaptation
4. Authorship - non-commercial - share under the same conditions
5. Authorship - no adaptation
6. Authorship - sharing under the same conditions

(Please circle only one of the six licenses, a brief description of the licenses is provided on the back of the sheet).

PhD student signature

Belgrade, December 17, 2022

1. Authorship - You permit the reproduction, the distribution and the public communication of the paper, as well as the adaptation, provided that the author's name is mentioned in the manner specified by the author or the licensor, even for commercial purposes. This is the most free of all licenses.

2. Authorship - non-commercial. You permit the reproduction, the distribution and the public communication of the work, as well as the adaptation, provided that author's name is indicated in the manner specified by the author or the licensor. This license does not permit commercial use of the paper.

3. Authorship - non-commercial - no adaptation. You permit the reproduction, the distribution, and the public communication of the paper, without any modification, transformation, or use of the paper in your own work, provided that the author's name is indicated in the manner specified by the author or licensor. This license does not permit commercial use of the work. Comparing to all other licenses, this license limits to the maximum the use of the paper.

4. Authorship - non-commercial - sharing under the same conditions. You permit the reproduction, the distribution, and the public communication of the paper, as well as the adaptation, provided that the author's name is credited in a manner specified by the author or licensor and that the adaptation is distributed under the same or similar license. This license does not permit commercial use of the paper and its adaptations.

5. Authorship - no adaptation. You permit the reproduction, the distribution, and the public communication of the paper, without any modification, transformation, or use of the paper in your own work, provided that the author's name is indicated in the manner specified by the author or licensor. This license permits commercial use of the work.

6. Authorship - sharing under the same conditions. You permit the reproduction, the distribution, and the public communication of the work, as well as the adaptation, provided that the author's name is credited in a manner specified by the author or licensor and the adaptation is distributed under the same or similar license. This license permits the commercial use of the paper and its adaptations. It is similar to the software licenses, i.e. open source licenses.

Прилог 1.

Изјава о ауторству

Потписани Mubarak Saeed Ahmed Burshaid Al-Dhaheri

број уговора 1А/2019 са датумом потписивања 1. октобра 2019. године

Изјављујем

да је докторска дисертација под насловом

MEETING THE CHALLENGES OF BIOLOGICAL THREATS:STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

- резултат сопственог истраживачког рада,
- да предложена дисертација у целини ни у деловима није била предложена за добијање било које дипломе према студијским програмима других високошколских установа,
- да су резултати коректно наведени и
- да нисам кршио/ла ауторска права и користио интелектуалну својину других лица.

Потпис докторанда

У Београду, 17. децембра 2022. године

Прилог 2.

Изјава о истоветности штампане и електронске верзије докторског рада

Име и презиме аутора Mubarak Saeed Ahmed Burshaid Al-Dhaheri

Број уговора 1А/2019 са датумом потписивања 1. октобра 2019. године

Студијски програм "Инжењеринг и менаџмент стратешких безбедносних система"

Наслов рада MEETING THE CHALLENGES OF BIOLOGICAL THREATS:STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

Ментор Проф. др Елизабета Ристановић

Потпис ментор

изјављујем да је штампана верзија мог докторског рада истоветна електронској верзији коју сам предао/ла Универзитетској библиотеци **Универзитета „Унион-Никоа Тесла“ у Београду.**

Дозвољавам да се објаве моји лични подаци везани за добијање академског звања доктора наука, као што су име и презиме, година и место рођења и датум одбране рада.

Ови лични подаци могу се објавити у електронском каталогу и у публикацијама Универзитета „Унион- Никола Тесла“у Београду.

Потпис докторанда

У Београду, 17. децембра 2022. године

Прилог 3.

Изјава о коришћењу

Овлашћујем Универзитетску библиотеку Универзитет „Унион-Никола Тесла“ да у Дигитални репозиторијум Универзитета унесе моју докторску дисертацију под насловом:

MEETING THE CHALLENGES OF BIOLOGICAL THREATS:STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES

која је моје ауторско дело.

Дисертацију са свим прилозима предао сам у електронском формату погодном за трајно архивирање.

Моју докторску дисертацију похрањену у Дигитални репозиторијум Универзитета „Унион-Никола Тесла“ могу да користе сви који поштују одредбе садржане у одабраном типу лиценце Креативне заједнице (Creative Commons) за коју сам се одлучио.

1. Ауторство
2. Ауторство - некомерцијално
3. Ауторство – некомерцијално – без прераде
4. Ауторство – некомерцијално – делити под истим условима
5. Ауторство – без прераде
6. Ауторство – делити под истим условима

(Молимо да заокружите само једну од шест понуђених лиценци, кратак опис лиценци дат је на полеђини листа).

Потпис докторанта

У Београду, 17. децембра 2022. године

_____

УНИВЕРЗИТЕТ „Унион-Никола Тесла“
Факултет за инжењерски менаџмент

ДОКУМЕНТАЦИЈСКА ИНФОРМАЦИЈА

Врста рада:	Докторска дисертација
Име и презиме аутора:	Mubarak Saeed Ahmed Burshaid Al-Dhaheri
Ментор (титула, име, презиме, звање, институција)	Проф. др Елизабета Ристановић, редовни професор, Универзитет Одбране у Београду
Наслов рада:	MEETING THE CHALLENGES OF BIOLOGICAL THREATS:STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES
Језик публикације (писмо):	Енглески (латиница)
Физички опис рада:	Унети број: Страница 129 Поглавља 5 Референци 195 Табела 1 Слика - Графикона - Прилога 2
Научна област:	Техничко-технолошке науке
Ужа научна област (научна дисциплина):	Индустријско инжењерство/инжењерски менаџмент
Кључне речи / предметна одредница:	Weapon of mass destruction (WMD), Biological weapons (BW), Biological Weapons Convention (BWC), Non-Proliferation Control Regimes, Organization for prohibition of bioweapons (OPBW). / Defence Systems
Резиме на језику рада:	There is no doubt that the security architecture of the world is rapidly and dynamically changing in the time we live in. These changes bring new security challenges. One of them is certainly the increasing danger of possible use of biological weapons in war and terrorist activities. Biological warfare has always attracted people, since the earliest times of civilization, and in all wars, many people died from epidemics of infectious diseases that are a natural companion of war conflicts. During the Cold War period, biological weapons (BW) were part of the arsenals of both world superpowers. Nevertheless, September 11, 2001 represents a turning point after which the use of weapons of mass destruction (WMD), including biological ones, becomes part of the propaganda narrative following each local or regional war conflict that have been fought since then. Until the beginning of the COVID-19 pandemic, in the background of which all the time was taking place serious geopolitical game, as well as the beginning of the great re-composition of the world that is inexorably moving towards multicentrism, as it is clearly confirmed by recent events on the world stage, assessments of the prospects and the effects of the possible use of biological weapons were reduced to the formulation "low probability-high consequence", and therefore great attention was paid to preventing and deterring of potential users, primarily by establishing legal regulations in national frameworks in order to sanction the potential production, storage, transfer and use of biological agents and their products - toxins. The basis for drafting such acts was the Convention on Biological Weapons (BWC) - Biological Convention from 1972 (full name of the document: *Convention on the Prohibition of the Development, Production and Storage of Bacteriological (Biological) and Toxic Weapons and on Their Destruction*), which has certain shortcomings, like any act of this nature and represents only an umbrella document

	in this area. According to the current regulations, the main role and responsibility for the implementation of the Convention rests with the signatory states, and it takes place through three levels (one of which is legally founded, the second is political, while the third one is completely voluntary). The UN Security Council has the role of final arbiter in the case of allegations of violations of the Biological Convention. The Implementation Support Unit supports Member States in their efforts to implement the provisions of the Convention, while the World Health Organization (WHO), the Food and Agriculture Organization of the UN (FAO) and the World Organization for Animal Health (OIE) have a potential expert and advisory role in clarifying events as well as the situations in this domain, in order to help the signatory states in comprehensively and successfully dealing with this complex international phenomenon. However, the level of verification remains one of the basic challenges related to the disarmament and prevention of the proliferation of biological weapons, because for some reason an independent expert international body under the auspices of the UN - *the Organization for the Prohibition of Biological Weapons* has not yet been formed. It seems for some reason politically unacceptable to most actors on the world stage, such as the negotiations on verification mechanisms that have been stalled for the past 20 years. The progress of science, especially in the field of molecular biology, biotechnology and nanotechnology, pharmacology, synthetic biology, can lead to serious consequences in terms of the further development of more dangerous and deadly biological weapons, whether it is a completely new, even genetically or ethnically specific or a result of modification of the existing ones, as well as it could present a combination with other biological, chemical and radiological, but also with conventional weapons. Accordingly, within the framework of international arrangements and multilateral agreements for prevention of the proliferation of weapons of mass destruction and subsequent control mechanisms, including those related to dual-use goods and assets, this problem should be a subject of specific and continuous monitoring. All this primarily refers to the already mentioned rapid development of science in this area, which brings fantastic benefits in the development of new drugs, diagnostic tools, therapy, but also makes possible development of potentially deadly and very specific biological weapons, as well as means and opportunities for their dissemination and spreading. This is precisely why databases related to the structures of the genomes of humans and microorganisms should be secured, the work of laboratories and their capabilities should be carefully monitored, the epidemiological and epizootological situation in the various geographic fields should be followed, and preventive measures and an adequate response should be undertaken in the event of a potential threat appearance. It must be a constant proactive task and obligation of all participants and the signatories of the Biological Convention, as well as of the mentioned international control body, the formation of which would be an imperative of the times, especially at the actual geopolitical moment. Rules and obligations must be equally binding for all actors, regardless of the size and power of states in the geopolitical arena. It is extremely important to implement measures of constant education and raising the awareness of researchers in this domain, as well as strengthening their ethical code, so that their knowledge is not misused for the further development of dangerous biological weapons. It is certainly a specific task for the intelligence-security, academic, medical-biological sectors, but it also must be an important area for the improvement of international cooperation in this domain. Preventing the proliferation of biological weapons certainly requires a qualitatively new approach and strengthening of mechanisms for the implementation of the Biological Convention at the international level, sincere cooperation, as well as essential results in the field of verification and control in order to strengthen international security and common development and prosperity.
Датум прихватања теме од стране надлежног већа:	05.10.2022. године
Датум одбране: (Попуњава одговарајућа служба)	17. децембар, 2022. године у Београду

Чланови комисије: (титула, име, презиме, звање, институција)	Председник	Проф. др Владимир Томашевић, *FRSA* Универзитет "УНИОН - Никола Тесла"
	Члан	Професор Емеритус Дарко Танасковић Универзитет за мир Уједињених Нација
	Члан	Проф. др Бранко Крга Универзитет "УНИОН - Никола Тесла"
	Члан	Проф. др Срђан Томић Универзитет "УНИОН - Никола Тесла"
	Члан	Проф. др Душан Пророковић, Институт за међународну политику и привреду, Београд
Напомена:		

„Union-Nikola Tesla“ UNIVERSITY
Faculty of engineering management

KEY WORD DOCUMENTATION

Document type:	Doctoral dissertation
Author:	Mubarak Saeed Ahmed Burshaid Al-Dhaheri
Supervisor (title, first name, last name, position, institution)	Prof. Dr. Elizabeta Ristanović, Full professor, University of Defence, Belgrade
Thesis title:	MEETING THE CHALLENGES OF BIOLOGICAL THREATS:STRENGTHENING THE UN ROLE IN BIOLOGICAL NON-PROLIFERATION REGIMES
Language of text (script):	English (latin)
Physical description:	Number of: Pages 129 Chapters 5 References 195 Tables 1 Illustrations - Graphs - Appendices 2
Scientific field:	Technical Sciences
Scientific subfield (scientific discipline):	Industrial engineering / Engineering Managmenet
Subject, Key words:	Weapon of mass destruction (WMD), Biological weapons (BW), Biological Weapons Convention (BWC), Non-Proliferation Control Regimes, Organization for prohibition of bioweapons (OPBW). / Defence Systems
Abstract in English language:	There is no doubt that the security architecture of the world is rapidly and dynamically changing in the time we live in. These changes bring new security challenges. One of them is certainly the increasing danger of possible use of biological weapons in war and terrorist activities. Biological warfare has always attracted people, since the earliest times of civilization, and in all wars, many people died from epidemics of infectious diseases that are a natural companion of war conflicts. During the Cold War period, biological weapons (BW) were part of the arsenals of both world superpowers. Nevertheless, September 11, 2001 represents a turning point after which the use of weapons of mass destruction (WMD), including biological ones, becomes part of the propaganda narrative following each local or regional war conflict that have been fought since then. Until the beginning of the COVID-19 pandemic, in the background of which all the time was taking place serious geopolitical game, as well as the beginning of the great re-composition of the world that is inexorably moving towards multicentrism, as it is clearly confirmed by recent events on the world stage, assessments of the prospects and the effects of the possible use of biological weapons were reduced to the formulation "low probability-high consequence", and therefore great attention was paid to preventing and deterring of potential users, primarily by establishing legal regulations in national frameworks in order to sanction the potential production, storage, transfer and use of biological agents and their products - toxins. The basis for drafting such acts was the Convention on Biological Weapons (BWC) - Biological Convention from 1972 (full name of the document: *Convention on the Prohibition of the Development, Production and Storage of Bacteriological (Biological) and Toxic Weapons and on Their Destruction*), which has certain shortcomings, like any act of this nature and represents only an umbrella document in this area. According to the current regulations, the main role and responsibility

	for the implementation of the Convention rests with the signatory states, and it takes place through three levels (one of which is legally founded, the second is political, while the third one is completely voluntary). The UN Security Council has the role of final arbiter in the case of allegations of violations of the Biological Convention. The Implementation Support Unit supports Member States in their efforts to implement the provisions of the Convention, while the World Health Organization (WHO), the Food and Agriculture Organization of the UN (FAO) and the World Organization for Animal Health (OIE) have a potential expert and advisory role in clarifying events as well as the situations in this domain, in order to help the signatory states in comprehensively and successfully dealing with this complex international phenomenon. However, the level of verification remains one of the basic challenges related to the disarmament and prevention of the proliferation of biological weapons, because for some reason an independent expert international body under the auspices of the UN - *the Organization for the Prohibition of Biological Weapons* has not yet been formed. It seems for some reason politically unacceptable to most actors on the world stage, such as the negotiations on verification mechanisms that have been stalled for the past 20 years. The progress of science, especially in the field of molecular biology, biotechnology and nanotechnology, pharmacology, synthetic biology, can lead to serious consequences in terms of the further development of more dangerous and deadly biological weapons, whether it is a completely new, even genetically or ethnically specific or a result of modification of the existing ones, as well as it could present a combination with other biological, chemical and radiological, but also with conventional weapons. Accordingly, within the framework of international arrangements and multilateral agreements for prevention of the proliferation of weapons of mass destruction and subsequent control mechanisms, including those related to dual-use goods and assets, this problem should be a subject of specific and continuous monitoring. All this primarily refers to the already mentioned rapid development of science in this area, which brings fantastic benefits in the development of new drugs, diagnostic tools, therapy, but also makes possible development of potentially deadly and very specific biological weapons, as well as means and opportunities for their dissemination and spreading. This is precisely why databases related to the structures of the genomes of humans and microorganisms should be secured, the work of laboratories and their capabilities should be carefully monitored, the epidemiological and epizootological situation in the various geographic fields should be followed, and preventive measures and an adequate response should be undertaken in the event of a potential threat appearance. It must be a constant proactive task and obligation of all participants and the signatories of the Biological Convention, as well as of the mentioned international control body, the formation of which would be an imperative of the times, especially at the actual geopolitical moment. Rules and obligations must be equally binding for all actors, regardless of the size and power of states in the geopolitical arena. It is extremely important to implement measures of constant education and raising the awareness of researchers in this domain, as well as strengthening their ethical code, so that their knowledge is not misused for the further development of dangerous biological weapons. It is certainly a specific task for the intelligence-security, academic, medical-biological sectors, but it also must be an important area for the improvement of international cooperation in this domain. Preventing the proliferation of biological weapons certainly requires a qualitatively new approach and strengthening of mechanisms for the implementation of the Biological Convention at the international level, sincere cooperation, as well as essential results in the field of verification and control in order to strengthen international security and common development and prosperity.
Accepted on Scientific Board on:	05.10.2022
Defended: (Filled by the faculty service)	17th of December, 2022

Thesis Defend Board: (title, first name, last name, position, institution)	President of panel	Prof. Dr. Vladimir Tomašević, FRSA "Union - Nikola Tesla" University
	Members of panel	Emeritus Darko Tanasković, PhD UN University for Peace
		Prof. Dr. Branko Krga "Union - Nikola Tesla" University
		Prof. Dr. Srđan Tomić "Union - Nikola Tesla" University
		Prof. Dr. Dušan Proroković, Institute of International Politics and Economics, Belgrade
Note:		

TABLE OF CONTENTS

ABSTRACT (SUMMARY):

There is no doubt that the security architecture of the world is rapidly and dynamically changing in the time we live in. These changes bring new security challenges. One of them is certainly the increasing danger of possible use of biological weapons in war and terrorist activities. Biological warfare has always attracted people, since the earliest times of civilization, and in all wars, many people died from epidemics of infectious diseases that are a natural companion of war conflicts. During the Cold War period, biological weapons (BW) were part of the arsenals of both world superpowers. Nevertheless, September 11, 2001 represents a turning point after which the use of weapons of mass destruction (WMD), including biological ones, becomes part of the propaganda narrative following each local or regional war conflict that have been fought since then. Until the beginning of the COVID-19 pandemic, in the background of which all the time was taking place serious geopolitical game, as well as the beginning of the great re-composition of the world that is inexorably moving towards multicentrism, as it is clearly confirmed by recent events on the world stage, assessments of the prospects and the effects of the possible use of biological weapons were reduced to the formulation "low probability-high consequence", and therefore great attention was paid to preventing and deterring of potential users, primarily by establishing legal regulations in national frameworks in order to sanction the potential production, storage, transfer and use of biological agents and their products - toxins. The basis for drafting such acts was the Convention on Biological Weapons (BWC) - Biological Convention from 1972 (full name of the document: *Convention on the Prohibition of the Development, Production and Storage of Bacteriological (Biological) and Toxic Weapons and on Their Destruction*), which has certain shortcomings, like any act of this nature and represents only an umbrella document in this area. According to the current regulations, the main role and responsibility for the implementation of the Convention rests with the signatory states, and it takes place through three levels

(one of which is legally founded, the second is political, while the third one is completely voluntary). The UN Security Council has the role of final arbiter in the case of allegations of violations of the Biological Convention. The Implementation Support Unit supports Member States in their efforts to implement the provisions of the Convention, while the World Health Organization (WHO), the Food and Agriculture Organization of the UN (FAO) and the World Organization for Animal Health (OIE) have a potential expert and advisory role in clarifying events as well as the situations in this domain, in order to help the signatory states in comprehensively and successfully dealing with this complex international phenomenon. However, the level of verification remains one of the basic challenges related to the disarmament and prevention of the proliferation of biological weapons, because for some reason an independent expert international body under the auspices of the UN - *the Organization for the Prohibition of Biological Weapons* has not yet been formed. It seems for some reason politically unacceptable to most actors on the world stage, such as the negotiations on verification mechanisms that have been stalled for the past 20 years. The progress of science, especially in the field of molecular biology, biotechnology and nanotechnology, pharmacology, synthetic biology, can lead to serious consequences in terms of the further development of more dangerous and deadly biological weapons, whether it is a completely new, even genetically or ethnically specific or a result of modification of the existing ones, as well as it could present a combination with other biological, chemical and radiological, but also with conventional weapons. Accordingly, within the framework of international arrangements and multilateral agreements for prevention of the proliferation of weapons of mass destruction and subsequent control mechanisms, including those related to dual-use goods and assets, this problem should be a subject of specific and continuous monitoring. All this primarily refers to the already mentioned rapid development of science in this area, which brings fantastic benefits in the development of new drugs, diagnostic tools, therapy, but also makes possible development of potentially deadly and very specific biological weapons, as well as means and opportunities for their dissemination

and spreading. This is precisely why databases related to the structures of the genomes of humans and microorganisms should be secured, the work of laboratories and their capabilities should be carefully monitored, the epidemiological and epizootological situation in the various geographic fields should be followed, and preventive measures and an adequate response should be undertaken in the event of a potential threat appearance. It must be a constant proactive task and obligation of all participants and the signatories of the Biological Convention, as well as of the mentioned international control body, the formation of which would be an imperative of the times, especially at the actual geopolitical moment. Rules and obligations must be equally binding for all actors, regardless of the size and power of states in the geopolitical arena. It is extremely important to implement measures of constant education and raising the awareness of researchers in this domain, as well as strengthening their ethical code, so that their knowledge is not misused for the further development of dangerous biological weapons. It is certainly a specific task for the intelligence-security, academic, medical-biological sectors, but it also must be an important area for the improvement of international cooperation in this domain. Preventing the proliferation of biological weapons certainly requires a qualitatively new approach and strengthening of mechanisms for the implementation of the Biological Convention at the international level, sincere cooperation, as well as essential results in the field of verification and control in order to strengthen international security and common development and prosperity.

Keywords:

Weapon of mass destruction (WMD), Biological weapons (BW), Biological Weapons Convention (BWC), Non-Proliferation Control Regimes, Organization for prohibition of bioweapons (OPBW).

SAŽETAK (REZIME):

Nesumnjivo je da se bezbednosna arhitektura sveta brzo i dinamično menja u vremenu u kome živimo. Ovakve promene nose i nove bezbednosne izazove. Jedan od njih je svakako sve veća opasnost od moguće primene biološkog oružja u ratu i terorističkim dejstvima. Biološko ratovanje je uvek privlačilo ljude, još od najstarijih vremena nastanka civilizacije, a u svim ratovima je mnogo ljudi stradalo od epidemija zaraznih bolesti koje su bile prirodni pratilac svakog ratnog sukoba, dok je u periodu Hladnog rata biološko oružje bilo deo arsenala obe svetske super sile. Ipak, 11. septembar 2001. godine predstavlja prekretnicu nakon koje primena oružja za masovno uništenje, uključujući i biološko postaje deo propagandnog narativa koji prati svaki lokalni ili regionalni ratni sukob vođen od tada. Sve do početka pandemije COVID-19 u čijoj pozadini se sve vreme odigravala geopolitička utakmica koja je predstavljala početak velike prekompozicije sveta koji se neumitno kreće ka multicentrizmu, što potvrđuju i potonja zbivanja na svetskoj sceni, procene o izgledima upotrebe i efektima eventualne primene biološkog oružja svodile su se na formulaciju *mala verovatnoća - velike posledice,* pa je stoga velika pažnja posvećivana sprečavanju i odvraćanju eventualnih korisnika, pre svega uspostavljanjem zakonsko-pravnih regulativa u nacionalnim okvirima koje sankcionišu potencijalnu proizvodnju, skladištenje, transfer i upotrebu bioloških agenasa i njihovih produkata - toksina. Osnov za izradu ovakvih akata predstavljala je *Konvencija o biološkom oružju-Biološka konvencija* iz 1972. godine (pun naziv dokumenta: *Konvencija o zabrani razvoja, proizvodnje i skladištenja bakteriološkog (biološkog) i toksičnog oružja i o njihovom uništavanju*, koja, kao i svaki akt ovakvog karaktera ima određene nedostatke i predstavlja samo krovni document u ovoj oblasti. Prema dosadašnjoj regulativi, glavna uloga i odgovornost za sprovođenje Konvencije leži na državama potpisnicama, a odvija se kroz tri nivoa (od kojih je jedan pravno obavezujući, drugi politički i treći potpuno dobrovoljan), dok Savet bezbednosti UN ima ulogu konačnog arbitra u slučaju optužbi za kršenje Biološke konvencije.

Jedinica za podršku implementaciji podržava države članice u njihovim naporima da sprovedu odredbe Konvencije, dok Svetska zdravstvena organizacija (SZO), Organizacija za hranu i poljoprivredu UN (FAO) i Svetska organizacija za zdravlje životinja (OIE) imaju potencijalnu stručnu i savetodavnu ulogu u razjašnjavanju događaja i situacija iz ovog domena, kako bi pomogle državama potpisnicama u sveobuhvatnom i uspešnom suočavanju sa ovim složenim međunarodnim fenomenom. Međutim, nivo verifikacije ostaje i dalje jedan od bazičnih izazova vezano za razoružanje i sprečavanje proliferacije biološkog oružja, jer iz nekog razloga pod pokroviteljstvom UN još uvek nije formirano nezavisno ekspertsko međunarodno telo – *Organizacija za prohibiciju biološkog oružja* koje je izgleda iz nekog razloga politički neprihvatljivo za većinu aktera na svetskoj sceni, kao što su i pregovori o mehanizmima verifikacije u zastoju poslednjih 20 godina. Napredak nauke posebno u domenu molekulske biologije, biotehnologije i nanotehnologije, farmakologije, sintetske biologije, može dovesti do ozbiljnih posledica u smislu daljeg razvoja opasnijeg i ubojitijeg biološkog oružja, bilo da je reč o potpuno novom, čak genetski ili etnički specifičnom oružju ili modifikovanju postojećeg, kao i njegovoj kombinaciji sa biološkim, hemijskim i radiološkim, ali i konvencionalnim oružjem, pa shodno tome, u okviru međunarodnih aranžamana i multilateralnih sporazuma za sprečavanje proliferacije oružja za masovno uništenje i kontrolnih mehanizama, uključujući ona vezana za robu i sredstva dvostruke namene, ovaj problem treba posebno i kontinuirano pratiti. To se pre svega odnosi na već pomenuti brzi razvoj nauke u ovoj oblasti, koji donosi fantastične benefite u razvoju novih lekova, dijagnostičkih sredstava, terapije, ali i potencijalno ubojitog i vrlo specifičnog biološkog oružja, kao i sredstava i mogućnosti za njihovu diseminaciju i širenje. Upravo zato treba osigurati i obezbediti i baze podataka koje se odnose na strukture genoma ljudi i mikroorganizama, nadzirati rad laboratorija i njihove mogućnosti, pratiti epidemiološku i epizootološku situaciju na terenu, ali i preduzimati mere prevencije i adekvatnog odgovora u slučaju pojave pretnje. To mora biti stalni proaktivni zadatak i obaveza svih učesnika potpisnica Biološke konvencije, kao i pomenutog međunarodnog kontrolnog tela čije bi formiranje

bilo imperativ vremena. Pravila i obaveze moraju biti podjednako obavezujuće za sve aktere, nezavisno od veličine i moći država u geopolitičkoj areni. Izuzetno je važno sprovoditi mere konstantnog obrazovanja i podizanja svesti istraživača u ovom domenu, kao i jačanja njihovog etičkog kodeksa, kako njihova znanja ne bi bila zloupotrebljena za dalji razvoj opasnog biološkog oružja. To je svakako specifičan zadatak i za obaveštajno-bezbednosni, akademski, medicinsko-biološki sektor, ali i značajno polje za unapređenje međunarodne saradnje u ovom domenu. Sprečavanje proliferacije biološkog oružja svakako zahteva kvalitativno nov pristup i jačanje mehanizama implementacije Biološke konvencije na međunaronom nivou, iskrenu saradnju, kao i suštinske rezultate na polju verifikacije i kontrole u cilju jačanja međunarodne bezbednosti i zajedničkog razvoja i prosperiteta.

Ključne reči:

oružje za masovno uništenje (OMU), biološko oružje (BO), Biološka konvencija, režimi kontrole proliferacije, verifikacija, Organizacija za prohibiciju biološkog oružja.

1. INTRODUCTION

The world we live in is changing rapidly and dynamically. Within this, new security challenges are emerging. One of them, as old as human society, refers to the use of microorganisms (bacteria, viruses and their toxins) in order to cause disease or death, as well as economic, military, socio-political and other problems at the local, regional and/or international level.

The risks are amplified with the rapid progress of science and the possibilities of its potential misuse. The development of knowledge about the mechanisms of the pathogenic effects of microorganisms, their interaction with the host's immune system, as well as progress in the spheres of biotechnology, nanotechnology and genetic engineering have enabled manipulations at the level of the genomes of people and microorganisms, as well as work on the development of effective, even ethnically specific biological weapons. The development in the field of military sciences also enables progress in the sphere of modernizing the possibility of disseminating these weapons (e.g. unmanned aircraft - drones with canisters etc.) (Børsen Hansen, 2006).The potential use of such weapons would cause catastrophic consequences.

The actual COVID-19 pandemic, with its health, but also geopolitical, security, economic, socio-psychological consequences, reminds us of this, as well as the fact that weapons of mass destruction (WMD) - chemical, biological, radiological/nuclear, have represented a red the starting line for all armed conflicts fought in the world after the anthrax campaign in 2001 (Iraq, Syria, Ukraine, etc.) Qualitatively different, potentially very deadly, WMD becomes a real danger and the most difficult opponent to defeat, because it is relatively easily available, cheap, effective, difficult to recognize, and by its application in terrorist actions, their effects can be multiplied with potential to gain new, unknown and uncontrolled dimensions (Shang et al, 2021).

On the other hand, the national security strategies of most countries are inadequate and deficient in this segment, there are no clearly defined defense

mechanisms, as well as the precise tasks and obligations of entities that should participate in the prevention and treatment of biological accidents, biological threats and possible biological attacks. Even existing international control regimes are not completely elaborated and precise, presenting the subject to different, often arbitrary interpretations (Gigi, 2012, Mair & Mair, 2006).

According to scientific estimates, there are about 2-3 million different microorganisms in nature, and only about 5% of them have been identified to date, while diseases caused by microorganisms are among the top ten leading causes of death in the world. About 15 million people on the planet die from infectious diseases every year. The highest percentage of the occurrence of infectious diseases is recorded in underdeveloped countries (62% in Africa, 31% in South-East Asia), while in developed countries, despite progress in eradicating traditional diseases, new infectious disorders have appeared. In this regard, migrations from biological risk zones must also be considered from a health-security perspective (Ristanović, 2009). The appearance and development of infectious diseases are influenced by various factors, among them climate changes play a significant role, leading to the endangerment of natural habitats and life cycles thus affecting microorganisms and enabling the emergence of new infectious diseases. In recent years, the Arctic region has been very interesting for the most powerful actors on the world stage related to the exploration of mineral resources, oil and gas reserves, which can also lead to the awakening of microorganisms sleeping under the ice-cover (Yadav, 2022).

The anthrax campaign in 2001 in the USA, as well as the subsequent epidemics of SARS, avian flu and Ebola, the swine flu pandemic with all the controversies that followed it, and especially the COVID-19 pandemic, show that microorganisms are a real and ubiquitous danger with unforeseeable consequences for health, the environment and society, and accordingly represent a serious security risk in themselves, while the unlimited possibilities of manipulation that science and technology, as well as information and cyber-space in this domain provide today, encourage a real fear of their misuse and application in war and bioterrorist acts, especially in the time of the accumulated

contradictions of modern civilization and the accelerated changes in the security architecture of the world that we are witnessing (Ristanović & Zejak, 2020).

In order to train capacities and resources for protection against biological agents, it is necessary to have a good knowledge of biological laws, characteristics of microorganisms, ways and methods of their application, related to the ecological and epidemiological situation in the field, meteorological and biophysical circumstances, as well as methods of detection and identification of them and actions in the event of a possible biological attack, whether it is a war or a terrorist act, including the treatment of injured, sick and/or exposed persons, prophylaxis of the healthy, decontamination of the terrain, but also the entire crisis management in such situations (Eneh, 2012).

It is particularly important to strengthen the mechanisms and norms of control of these weapons at the international level, with an emphasis on the role of the United Nations in monitoring potential biological weapons, as well as on more sincere support for the implementation of the provisions of the existing Biological Convention, which entered into force in 1975, especially by the most prominent actors on the international stage (Edwards et al, 2022). The implementation of the Convention provisions must be harmonized and binding on several conceptual levels, including political, legal, but also the completely voluntary one, which must be the result of the awareness of all relevant people, from scientists to decision makers, about the importance and dimensions of the threat (Zilinskas, 1992).

The problem of verification remains one of the fundamental challenges in this area, and the role of the signatory states is particularly important here, while the UN should play the role of the final arbiter through the Implementation Support Unit. (Dunworth et al, 2006). It is interesting that until now no one has asked for the intervention or support of the UN Security Council in that field. This was done for the first time by the Russian Federation in April 2022, with the support of the People's Republic of China in the seeking of confirmation for allegations about biological laboratories in the post-Soviet space. The times in which we live, more than ever until now, impose the necessity of constituting an

international body under the auspices of the UN for the control and constant monitoring of the implementation of the Biological Convention. The question arises why this has not been done until now, because such solutions have long existed in the sphere of chemical and radiological/nuclear weapons? Is now the right time for such initiative, which must be launched on a diplomatic, but also on a professional level, with the consent of the most powerful actors on the world stage?

1.1. The history of biological warfare and bioterrorism

War and microorganisms are historical allies because hygienic-epidemiological conditions in war favor the development of infectious diseases, which is the reason why in all wars up to the 20th century, soldiers were more afraid of disease than the enemy's weapons (Barras & Greub, 2014). For every killed soldier in combat operations, 2 to 17 of them died from infectious diseases in past wars, which often decisively influenced the outcome of the conflicts. So, for example, in the war fought between Athens and Sparta, the so-called the Athenian plague killed as many as 47,000 soldiers (Grmek, 1979), while typhus, along with the Russian winter, was one of Napoleon's biggest opponents during the failed campaign on Moscow.

In addition to the natural reasons that led to the emergence of infectious diseases in wars, people early recognized all the advantages of biological warfare itself. Thus, even in the 4th century BC, the Scythians used arrows soaked in the blood of those who had contracted and died from infectious diseases, while Hannibal expelled infected people from the conquered territories to the Roman camps, deliberately spreading the infection among the enemies. In the 1st century BC, the soldiers of Julius Caesar in the attack on Gaul, threw the corpses of those who died from cholera into wells, causing water poisoning. In the Middle Ages, the corpses of people and animals who died from infectious diseases were thrown into fortified cities using catapults. Thus, in 1346, the Mongols introduced the plague ("black death") to the port of Caffa, Feodosia, Crimea, and from there by

the infected European traders, the disease was spread and later killed more than 25 million people (Wheelis, 2002). In the campaign against the Incas, in 1528, Pizarro "gifted" them clothes contaminated with the smallpox virus, while in 1650 the Poles used cannon shells containing the saliva of rabid dogs. During their campaign in North America, the British colonizers gave humanitarian aid to the indigenous tribes in the form of blankets, sheets and handkerchiefs contaminated with the excrements of smallpox patients.

During the First World War, biological agents were intensively used, primarily the causes of zoonoses, human and animal diseases. Germany worked most actively on the development, production and application of such biological weapons (Carus, 2015). Thus, in 1914, German intelligence agents in the USA infected horses intended for the military forces of the Allies in Europe with the causative agent of melioidosis (sakagia), which was described as the first case of biological diversion. The period between the two world wars was marked by the Spanish flu pandemic, caused by the influenza A (H1N1) virus. A third of the world's population was then infected, and about fifty million people died, that was five times more than in the First World War itself (Robertson & Robertson, 1995).

In order to better study the virulence and pathogenicity of this virus, it was reconstructed at the beginning of the 21st century by experts from the Centers for Disease Control and Prevention (CDC) from Atlanta from samples obtained after the exhumation of a woman - the Spanish flu victim who was buried in the permafrost of Alaska. Great scientific and public attention was focused on these studies because of the global fear that avian and swine flu, also caused by influenza A viruses (H5N1 and H1N1), which appeared in that period, could cause a pandemic like the one from 1918-1919, that, fortunately, did not happened (Kaiser, 2005). This also opened up the question of what is hidden under the ice sheet and whether its melting will allow many other viruses to come into surface.

In the period between the two world wars, Great Britain also began researching the characteristics of anthrax as a biological weapon, which were

finalized in 1942 with field tests on the island of Gruinard near Scotland, by dispersing anthrax spores using aerial bombs. The spores were found in a viable state even few decades later, while the island was decontaminated with formaldehyde and sea water in 1986.

Before the beginning of the Second World War, started the development of the biological program in Japan, with the formation of the so-called Unit 731 that was headed by Major Shiro Ishii, who was until the end of the war promoted to the rank of general, as a prize for his work on the testing and the use of biological weapons as well as the terrifying *in vivo* experiments his unit conducted over the Chinese population in the occupied territories that resulted in a large number of casualties. For instance, it is reliably known that about 400 thousand Chinese people died only as a result of deliberately infection with bubonic plague conducted by Unit 731 (Barenblatt, 2004). After the war, Shiro Ishii handed over the results of his research to the USA in exchange for amnesty.

By the way, the USA and Japan had not yet ratified the Geneva Protocol on the Prohibition of the Use of Biological Agents, which had been in force since 1925, so they had no formal obstacles to work in this field. During that period, Nazi Germany massively distributed malaria vectors in the Pontine Marshes in Italy, and the losses of the Allies caused by the disease then amounted to 100 thousand people (Robertson&Robertson, 1995).

In the USA, the development of the state biological program began in 1942 with the building and construction of appropriate facilities in Fort Detrick, Maryland, so that by the end of the war, 6,500 people was employed in 250 facilities, and the total budget during the war period for this purpose increased from 3.5 to 60 million dollars (Guillemin, 2004). Work on the production of anthrax weapons, bombs and projectiles filled with this agent was particularly intensive. In 1944, Winston Churchill ordered 500,000 anthrax bombs from the USA with the intention of using them against the Germans. If it had happened, the spores would have caused decades of contamination and paralyzed life in all large German cities. In the following years, cluster bombs with anthrax filling were also produced, with the intention of using them against the USSR. However, due to the

observed problems with the standardization of this ammunition, the large infectious dose (ID50 8000-10000 anthrax spores) required for the onset of the disease, as well as the long-term contamination that would occur after the use, anthrax was soon replaced by other pathogens, such as the causative agents of tularemia, brucellosis, Q - fever, various viruses, as well as fungi which cause diseases of useful plants - cereals, rice, cotton (*Pirucularia orizae, Sclerotum rolfsii*...). Possible routes of application of these agents and their aerosol dispersion were constantly being modernized. The research activities and work were also carried out on the examination of biological toxins, products of microorganisms, as well as the products of plants and animals (Leitenberg, 2001).

Confirmation of intensive work on the biological program in the USSR during the Second World War were the causative agents of dysentery, anthrax, and cholera found in Soviet spies captured by the Japanese. A base for testing biological weapons in the Aral Sea was opened in 1954, and by 1956 a huge industry for the production of biological weapons in the Soviet Union was already working (Guillemin, 2004).

Intensive biological programs were also developed in other countries (Great Britain, France, China, South Africa), with the use of cutting-edge technologies, which could lead to an unsuspected proliferation of biological weapons and the outbreak of the first biological warfare (Cirincione et al, 2005; Heinonen, 2016).

The "Biopreparat" program, which dealt with the study of existing and production of modified microorganisms was established in the USSR with about 60,000 employed people who worked on the production of large quantities of pathogenic microbes (causative agents of anthrax, plague, tularemia, smallpox, typhus) and their packaging in ammunition for conventional and modern weapons, especially in rockets of various types and ranges, including the intercontinental ones (Leitenberg et al, 2012). During the research with Marburg virus, in 1988, in Novosibirsk, one researcher was accidentally injured and died of the infection not long after that. After the end of the Cold War and the collapse of the USSR, a large number of scientists engaged in the "Biopreparat" program,

headed by the management staff, immigrated to the USA. There was also the fear that many of them went to various other countries of the world, as well as the suspicion that a transfer of pathogenic biological agents and production technologies could also happened (Wheelis, 2006; Carus, 2015).

Although officially no one is engaged in the production of biological weapons today, it is difficult to prove it, because the possession of it can be justified by using for defensive purposes (Pearson, 2020), as well as for testing the protection, diagnostics, immunization and other preventive measures. But, according to Henry Kissinger, " *it does not exclude the examination of offensive aspects of biological agents because is necessary for establishing protective measures*". There were and still are suspicions that some other countries have biological weapons in their arsenals, although they have never been officially proven (Alberque, 2022).

Nevertheless, the possibility of using biological agents in bio-criminal and/or bioterrorist acts certainly seemed and it is the most realistic, as it was evidenced by numerous cases from the not-so-distant past (Carus, 2001). So, for example, in 1972, members of the "Order of the Rising Sun" cult acquired 30-40 kg of typhoid agent with the aim of infecting the water supply system on the West Coast of the USA (Chicago, St. Louis, etc.). Bulgarian dissident Georgi Markov was killed in 1978 in London with a ricin-toxin capsule placed in an umbrella. The "Rajneesh" cult in Oregon, USA, in 1984, contaminated the food in restaurants with bacteria *Salmonella typhimurium* (Christopher et al, 1997) and 751 people fell ill from enterocolitis caused in this way. The goal of the terrorists was to prevent the citizens to participate in local elections. Members of the Aum Shinrikyo cult in Japan repeatedly tried to use some biological agents, such as botulinum toxin and anthrax, but their attempts were not successful because they possessed vaccine strains of bacteria. They also several times tried to reach the Ebola virus and the causative agent of Q-fever (Jonathan, 1995/2000).

The anthrax campaign in the USA, in 2001, is certainly a turning point in the relationship to the problem of bioterrorism. After the distribution of letters containing powder with anthrax spores, 22 people fell ill: 11 from skin anthrax,

11 from pulmonary anthrax, five people died, and millions of citizens were gripped by panic (Loch, 2002). Namely, the letters contained a fine powder with as many as a trillion spores per gram of substance, from which an infectious aerosol was created extremely easily. All isolates obtained from patient and environmental samples were identical, they belonged to the "Ames" strain of *Bacillus anthracis*, which was used in biological weapons research in the USA and Great Britain. The mentioned facts additionally drew the attention of investigative authorities to personnel who worked in specialized institutions of this profile and led to the conclusion that the immediate perpetrator of this act was military microbiologist Bruce Ivins, who subsequently ended up in prison, where he committed suicide in 2008. It additionally raised questions related to the aspect of biological security and the supervising of persons who come into contact with potential biological agents (Jeffrey, 2013).

Although the number of victims of the anthrax campaign was not large, the other consequences were huge and enormous. Here, above all, it is necessary to take into account the engagement of teams of experts of various profiles, the bacteriological processing of 1,125,000 samples, the consumption of 3.75 million doses of antibiotics to protect over 10,000 exposed persons, the cost of a billion dollars related to better preparation of health care etc. The funds in the budget intended for combating against biological weapons were rapidly increased every subsequent year (2001 - 414 million, 2002 - 3.4 billion, 2003 - 4.9 billion, 2004 - 5.5 billion, 2005 - 7.6 billion dollars) (Barras & Greub, 2014).

The African swine fever that broke out in 2007 caused damage worth 600 million dollars in Russia alone. Therefore, the economic dimension of bioterrorist acts and their disposal, as well as biological defense as a whole, have such dimensions that one can rightly speak of economic terrorism (Carus, 2015). When the Ebola epidemic appeared in West Africa in 2014, the World Bank reacted extremely quickly with projections of the so-called "Low & High Ebola Scenarios" which referred to the possible material costs of dealing with this epidemic and ranged between 1.6 and 32 billion dollars. The engaged military medical services of the leading countries of the world also highlighted the

material costs of their activities in this part of the African continent that is extremely rich in minerals and precious stones. However, no one mentioned the infrastructural deficiencies, the lack of professional staff, the insufficiently developed health care system. No one recognized the need to truly help the vulnerable population by investing in the development of the mentioned resources there (Ristanović, 2015a).

The economic consequences of the COVID-19 pandemic at the global and national levels are yet to be tallied and analyzed, as well as the enormous revenues of pharmaceutical companies generated during the pandemic itself. UN reports say the pandemic has pushed 77 million people into extreme poverty. We should not forget the so-called non-material damage of such events, which refers to causing stress, fear and panic that seriously endanger everyday life and work (Shang et al, 2021). This problem is particularly relevant today, in the era of social networks that can also be misused to generate panic and form public attitudes, which leads to the impossibility of adequate response by the state and competent entities, but also to the creation of distrust. After all, information warfare is a part of the totality of modern hybrid wars.

1.2. Great epidemics in history and their geopolitical implications

It is well known that disease epidemics or pandemics have changed the course of history and, as previously stated, decided the outcome of wars in the past, as well as influencing geopolitical trends today (Warren&Maxfield, 1996). Here, only some of them will be mentioned.

The plague (black death) is a zooanthroponosis caused by the bacterium *Yersinia pestis*. It first appeared in the Himalayas, from where it spread to the east (China), west (Middle East and Europe) and south (Indian subcontinent). It was recorded that in the Roman Empire in the period 167-164 BC about 1,094,000 Romans died from the plague. Epidemics of the plague have repeatedly affected Europe throughout history. Since the ecological conditions have not been qualitatively changed, the potential danger of the introduction and spread of the

plague is still present today, especially in the case of emergency situations. It can be spread by aerosols or vectors (fleas). Reservoirs are the rodents. Interhuman transmission is easily achievable, and strict isolation of the infected is required. The causative bacterium belongs to class A of potential biological agents. During the Russo-Japanese War in 1905, the Japanese carried out diversions against the opposing side with materials infected with the causative agents of plague and cholera. During World War II, the Japanese used infected fleas as vectors and caused epidemics in China (Barenblatt, 2004). After the war, the USA and the USSR developed techniques for preparing aerosols as well as genetic modification of bacteria (e.g. the superpowers developed strains resistant to 16 types of antibiotics). In 1970, the WHO estimated that the application of 50 kg of these bacteria in the form of an aerosol to a city of 5 million inhabitants would lead to the appearance of pneumonic plague in 150,000 people, and that 36,000 of them would die. In the form of an aerosol, the plague bacilli would remain alive for 1 hour in a diameter of 10 km, which would lead to the further spread of the infection. After applying the bacterial aerosol, incubation would last 1-6 days, then could appear signs and symptoms like fever, cough, dyspnea, gastrointestinal disorders, sepsis, while the death usually occurs in 2-6 days (Ristanović, 2015a). The appearance of the plague in the post-Soviet area, especially on the tri-border of China, Mongolia and Russia in the previous period is also interesting and it can be brought into the context of the existing natural hotspots, but the research carried out in the biological laboratories established in that area could be also taken into consideration.

Cholera is an acute intestinal infection caused by the bacillus *Vibrio cholerae*. Mass epidemics in India, which is an endemic focus of the disease, have been recorded since the 6th century BC until the beginning of the 16th century. At the beginning of the 19th century, cholera spread on a pandemic scale to all continents. The last epidemic in Europe was recorded in 1922 in Russia. During the Second World War, the Japanese, as a part of the biological program, produced 100 kg of biomass of this bacterium per month. Until the adoption of the Biological Convention, all states had cholera in their arsenals of biological

weapons (Cirincione et al, 2005). Otherwise, cholera is a low lethality disease. It can be spread through contamination of water or food. Interhuman transmission is also possible.

Rickettsioses are zoonoses caused by bacteria of the order *Rickettsiales*, demanding microorganisms and potential biological agents. Epidemic typhus is known and described in ancient Greece in the 5th century BC (Grmek, 1979). In the New World, it was first described in Mexico in 1517. In that area, 2,000,000 Indians died. It was widespread in Europe, especially in wartime. In Russia in the period 1918-1922, about 3,000,000 people died from typhus. According to WHO estimation from 1970, the hypothetical aerosol dissemination of 50 kg of spotted typhus agent to a city of 500,000 would kill 19,000 and incapacitate 85,000 people. Otherwise, the lethality of this disease is up to 30% in untreated patients, mainly as a result of generalized sepsis (Ristanović, 2015b).

Viruses (*virus=poison*) are the smallest and simplest microorganisms, actually supramolecular structures. They reproduce only in a living cell, so they are considered as energy parasites. As many as 60% of the viruses described so far have zoonotic potential, and a large number of them, after transferring from animals to humans, can also spread among humans, causing pandemics, epidemics and epizootics. In their natural form, the variola virus and the influenza virus have caused the most adversity to mankind. Viruses have always been intriguing for use as biological weapons. Within the Japanese biological weapons program, during the Second World War, viruses had a special place (influenza viruses, smallpox, tick-borne meningoencephalitis virus and many others). During the Cold War and the race in the development of biological weapons, and even after the signing of the Biological Convention, the two biggest superpowers of that time paid a lot of attention to the research of various viruses that could be used as weapons (Christopher et al, 1997). Due to the discovery of new viruses, their share among potential biological agents is increasing. Genetic engineering and biotechnology have also opened the door to the possibility of modifying existing and creating new viruses whose application effects would be unfathomable.

As a potential biological weapon, these microorganisms are increasingly important because the genome of most viruses is known nowadays, which opens up a wide field of possible manipulations. The advantages of using the virus as a biological weapon should be found in the fact that very small amounts of virus particles are needed for the infection (theoretically only 1 smallpox particle can cause disease), the production is relatively easy and cheap and it can be done with available equipment (both in hidden and mobile laboratories) and that large quantities of virus can be made in a short period of time (a few days or weeks) and distributed over a large area. This is supported by the words of Kathleen Bailey, the former assistant director of the US Army Control, who believes that "most of the biological arsenal can be created with $10,000 worth of equipment in a 5x5 m room." The disadvantages of the virus as a biological weapon relate to the difficulties in protecting people during the production, transport and use of the virus, which can lead to the occurrence of accidental infections due to insufficient training and protection of personnel or inadequate immunization. Because of their excessive sensitivity, most viruses require special storage conditions in order to maintain their virulence (low temperatures up to -70^0C, lyophilization, encapsulation), which further complicates their storage conditions. In a possible biological warfare, the viruses could be used in the form of aerosols, and the possibility of inoculating the virus into natural vectors - mosquitoes and ticks - should be also considered (Ristanović, 2015a).

Zika virus is an infectious agent from the genus of ***Flavivirus*** that was first identified in the human population in 1952 in the forests of the Zika province in Uganda. The reservoir of infection is still unknown. The vectors (mosquitoes from the genus *Aedes*) are necessary for transmission of the virus to humans (this mosquitoes also transmit Dengue, Chikungunya and Yellow Fever). The virus can be also transmitted through blood and sexual contact. The European Center for Disease Control and Prevention (ECDC) points to a possible link between Zika virus infection in pregnancy and fetal microcephaly, which has been under investigation since October 2015 when Brazil's Ministry of Health reported an unusual increase in cases of microcephaly following the Zika virus epidemic in

that country (Heukelbach et al, 2016). It is interesting that this epidemic caused a lot of media attention, and it happened during the period of the impeachment of Brazilian President Dilma Rousseff, as well as the change in the foreign policy course of South American countries and in the time of Olympics in Rio. Maybe it's just a random coincidence.

The family ***Bunyaviridae*** includes the largest group with more than 300 animal viruses. Reservoirs of these viruses are small rodents, vectors are mosquitoes and ticks, although some of these viruses can be transmitted directly from rodents to humans (*Hantaan virus*). The *Crimean-Congo hemorrhagic fever virus* (CCHF) and the *Hantaan* virus (named after the river between North and South Korea, where American soldiers and members of the UN were infected during the Korean War in 1951/1952) are particularly interesting as potential biological agents due to their high mortality rate (Lee, 1989).

Filoviruses are filamentous, 660-790 nm long and 60-80 nm wide particles. They are highly pathogenic. Their reservoirs are unknown, but the interhuman transmission makes them particularly dangerous. There are two viruses in this group: *Marburg* and *Ebola*. They cause severe hemorrhagic fevers with a mortality rate of up to 90%. Marburg virus was first described in the German cities of Marburg and Frankfurt, as well as in Belgrade in 1967 among laboratory personnel infected by contact with green monkeys (*Chlorocebus aethiops*) imported from Uganda for the preparation of the polio-vaccine. A total of 32 people fell ill (2 people in Belgrade), and 7 of them had a fatal outcome (Ristanović et al, 2020). The appearance of a deadly and previously unknown human infection caused then a great attention of the world public.

In the programs for the development of biological weapons in the USA and the USSR, the Marburg virus had an important place. Its current appearance in Ghana some authors and actors on the international scene link to biological activities carried out in Central Africa, as a current and actual monkey-pox phenomenon after all.

The Ebola virus was first described in 1975, while the first epidemics were recorded in the southern Sudan and Zaire. After that, the presence of virus was

also detected in other parts of Africa. The virus can be acquired through the blood or body fluids of infected people or animals. It is considered that men who have survived the disease can transmit it through their sperm for up to two months. Ebola could not be transmitted by aerosols. Patients with signs of hemorrhage die very quickly in the acute phase, before the appearance of specific antibodies.

During the Ebola epidemic in West Africa in 2014, which, according to the estimates, was the largest in so far history, according to the official WHO data, 17,223 people fell ill in Guinea and Sierra Leone. The presence of the virus was laboratory confirmed in 12,025 persons, while 6,475 people died of Ebola. In Liberia, there were 10,672 sick people, and 4,808 people died. Imported cases were reported in the UK, Italy, Spain (one each) and the USA (4 cases, 1 death) (WHO Ebola Response Team, 2016). This epidemic also caused numerous speculations, including those about a possible bioterrorist background, especially considering the natural resources of this part of Africa, but also its geopolitical importance. Researchers then, officially, came up with promising results with the Ebola vaccine. But there is still no cure and reliable vaccine for this virus.

The Ebola virus was very attractive to the carriers of the biological programs during the Cold War, and experiments were performed by crossing and recombination of its segments with the smallpox virus, in order to increase the effectiveness and lethality of this potential weapon (Ebolapox virus).

Variola (smallpox) virus belongs to the *Poxviridae* family. Its size is about 400nm. It can be transmitted via aerosols and air droplets through direct contact with an infected person, as well as through contaminated water, food and objects. Smallpox is a highly contagious disease. Incubation lasts 12-14 days. The disease begins suddenly, with flu-like symptoms, followed by the appearance of the characteristic smallpox, firstly on the face, hands and forearms, and then on the trunk. The two most common forms of the disease are: *variola major* (severe clinical form, mortality up to 30%) and *variola minor* (milder clinical course, mortality lower than 1%), while the most severe forms are *hemorrhagic* and *malignant variola*. The disease cannot be transmitted from an infected person during the incubation period. Contagiousness is highest at the time of temperature

rising and during the first week of the smallpox appearance. Symptomatic therapy and vaccination are used for treatment.

By the way, the vaccine against smallpox, which is the first vaccine in history, was made at the end of the 18th century by an English country doctor, Edward Jenner. He noticed that women who milked cows became infected with the so-called cowpox, but they did not get smallpox. Jenner's method paved the way for the vaccination campaign launched by the WHO in the 20th century, thanks to which smallpox was officially eradicated in 1979. It is important to point out that the variola vaccine can also be administered post-exposure, which is very important in providing of the protective immunity. Mandatory vaccination against smallpox was discontinued after the eradication of disease, so today's population is vulnerable (Parrino&Graham, 2006).

Otherwise, smallpox is considered one of the deadliest diseases in human history. It first appeared in China and the Far East 3000 years ago. Pharaoh Ramses V died of smallpox in 1157 BC. It appeared in Europe in 710. At the beginning of the 18th century, smallpox was the deadliest disease of the Old Continent and claimed the lives of 400,000 Europeans annually, including five rulers. It is estimated that between 300 and 500 million people died from smallpox in the 20th century.

As it was mentioned, the WHO adopted a plan to eradicate smallpox in 1967, and the last official case was recorded in Somalia in 1977. During the intensive eradication campaign, a smallpox epidemic occurred in Yugoslavia in 1972. It was the biggest post-war epidemic in Europe. Even then and today, there were doubts and speculations that it might have been a bioterrorist attack on Tito's Yugoslavia, although scientific facts do not support this claim. In the epidemic, a total of 175 people fell ill, and 35 people (20%) died (Ristanović, 2015b). The effectiveness and results of the work of the Yugoslav national laboratory and the health authorities as well as the whole country during the epidemic were highly rated by WHO experts.

Although the variola virus has been eradicated, according to official data it is kept in only two laboratories, at the CDC, Atlanta, USA, and at the Russian

State Center for Virology and Biotechnology (VECTOR) in Koltosovo, near Novosibirsk. However, the fear from its use as a potential biological agent is always present, given that it is a highly contagious pathogen, where one infected person can transmit the infection to 10 to 20 others, and therefore special protective measures are needed in patient care. In addition, the virus is well genetically studied and it can be easily genetically modified in order to disable the effects of the vaccine or increase its virulence. It is also possible to produce large amounts of virus in a very short time. The smallpox virus is very resistant to the external factors, so that it can survive for years and months in the various environmental conditions. It creates stable aerosols. All previously mentioned ranks the virus very high among potential biological weapons and it is taken seriously that could be substantiated by the fact that in the last years of the 20th century in the USA and some other countries of the world started intensive production of the vaccines against smallpox. (Ristanović et all, 2016).

The human immunodeficiency virus (HIV) belongs to the family of *Retroviridae*, and it causes the syndrome of acquired immunodeficiency, known as AIDS (AIDS). This unusual syndrome was firstly noticed in 1981, and the virus itself was identified and isolated four years later. According to WHO estimates, at the end of 2020, close to 40 million people in the world were infected with the HIV virus, about 2 million of them were children, and even 1 million people died only in that year. Up to 2 million new infections are recorded every year, and up to now nearly 40 million people have died from this infection and related diseases.

The epidemiological situation is particularly difficult in the countries of sub-Saharan Africa, where live practically 71% of the infected in the world. The risk of death from this disease is 10 times higher than from the armed conflicts that abound in this continent. The high rate of infection among members of the armed forces in this area (Kenya-75%, Congo-60%, Eritrea-10%) is of particular concern (Becker et al, 2008). There are also published papers about the impact of HIV infection on the recruiting potential of the Russian and Indian armies, in which this infection became a problem in a period since 1991 and after the

tectonic disturbances that led to the creation of a unipolar world, as well as the collapse of the socialist system and the Warsaw Pact (Elbe, 2020). Today, this problem must also be considered in the context of current migratory movements, because the largest number of migrants who passed through European geographic area in recent years have been coming from Africa and Southeast Asia, where the second highest incidence rate of these infections has registered.

Influenza (flu) is an infectious disease that is most often characterized by severe disorders of the general condition along with disorders of the upper respiratory tract. It is transmitted through aerosols or direct contact with contaminated hands and surfaces. Every year, several million people in the world get sick from this disease, and about 250,000 sufferers die. Mortality rate is less than 1%. The economic consequences of influenza epidemics are significant because the occurrence of a large number of patients requires large medical costs on an annual basis, as well as non-medical losses related to the absence from work, sick leave, etc. According to some estimates, the economic losses caused by the epidemic amount to 1-3 billion dollars each year (Jonas, 2013; World Bank, 2012).

There are historical records of major flu epidemics in Europe in 1510, 1557 and 1580. This latest epidemic spread to Africa and Asia and turned into the first known pandemic. Pandemics also frequently occurred later. The 1918/1919 pandemic was the most destructive in recent history. The pandemics of the "Asian flu" in 1957 caused by the N2N2 virus and the "Hong Kong flu" caused by the N3N2 virus are also known. The twenty-first century began with the H1N1 swine flu pandemic. The causative agent was a result of mutation and recombinations among human, bird and pig influenza. According to WHO statistics, it was officially announced that 18,000 people died in 2009, during this pandemic (Flahault & Zylberman, 2010).

Nevertheless, given that many unknowns remained regarding the structure and immunological status of patients who died from this flu, as well as the rapid finding of a vaccine and all the economic and other impacts that followed the vaccination procedure, and the sudden change in the definition of a pandemic by

the WHO, various speculations have been raised, especially in the context of the often mentioned fact that each pandemic in human history had a "socio-political background". Otherwise, the influenza virus is a potentially good candidate for possible use in the context of bioterrorist actions due to the possibility of aerosol transmission, high virulence and the possibility of genetic changes that are facilitated by the segmented structure of the genome (genetic shift and drift), as well as due to the economic, medical and other consequences caused by it (World Bank, 2012).

Corona viruses, that have become one of the main topic in the public discourse, due to the pandemic that broke out in China at the end of 2019, caused by the virus officially named COVID-19, are of zoonotic origin, as well as a large number of microorganisms, both newly discovered and those which we have known for a long time. This virus, according to the official explanations, jumped the species barrier, passing from animals to humans. Nevertheless, from the very beginning of the pandemic, have been raised many speculations about whether it is a natural virus or it "escaped" from a scientific research laboratory. The pandemic soon acquired geopolitical, economic, security and informational-psychological dimensions, the consequences of which are clearly recognized (Shang et al, 2021). Clinical and laboratory, as well as epidemiological reality, soon convinced us that this virus behaves significantly differently from all previously known corona viruses, that it spreads faster, binds to different receptors, causes different clinical manifestations, and shows atypical seasonality. Many experts and authorities in the field of virology and immunology, from the beginning, have made well-argued claims in favor of the artificial origin of the virus and even the presence of HIV virus sequences in it. The difference between the SARS and MERS viruses that also belong to the same family, which the world faced in 2003 and 2012, and this virus is in the structure of the proteins that bind to the receptors on the host's cells. The SARS virus, which infected 8,098 people, while 774 died (about 10%), was accompanied by pneumonia or respiratory distress syndrome. The timing of its appearance and the coincidence with the economic growth of the People's Republic of China in relation to the USA are

interesting. The origin of the MERS virus, the cause of Middle East respiratory syndrome, has not yet been fully determined, but based on current knowledge, it is suggested that it originated from bats and was transmitted to camels. Humans were probably infected by direct or indirect contact with infected camels. There were 2,494 laboratory-confirmed MERS cases, 80% of which were reported in Saudi Arabia, but the mortality rate was as high as 35%, 858 people died (Ristanović & Zejak, 2020).

The COVID-19 virus spreads through aerosols, via direct human-to-human contact, which is why the number of infected patients is so high. It is also possible that there is another way of transmission in the phase of viremia. According to the official WHO data, from the beginning of the pandemic to mid-April 2022, more than 500 million people fell ill, and about 6 million people died (slightly more than 1%). Nevertheless, the statistical data should be taken into account very relatively, because the number of patients is registered on the basis of the polymerase chain reaction (PCR) test positivity. But the detected segment of the corona virus nucleic acid is not a sure sign of neither-an active infection, nor the presence of a live virus into the human organism. Data on death outcomes are also disputed, because it is not known for sure whether people died from corona infection or with corona, as there is no data on their immune status and the presence of other diseases, while autopsies were not performed at all. Such mass testing has never been carried out until now.

Vaccination, instead of solving the problem, brought new turbulence. It became clear very soon that the health is not priority, but rather geopolitical and economic interests, so different vaccines were demanded in different countries, while others were not recognized. The effects and side effects of vaccines have not been adequately monitored. All this, along with unprecedented media pressure and the generation of fear and panic, led to an impact on the psycho-social field of people and the growth of tensions and divisions in society (Ristanović & Zejak, 2020).

The pandemic has shown how important and significant it is to have a well-developed health system, especially public health and preventive medical

services, but it also shown the important role of other segments of the state and society, including the intelligence and security sectors, as well as the importance and role of medical diplomacy. Time and science will answer many of these questions. The security sector will certainly analyze things from their point of view, not forgetting the simulation experiment of a pandemic caused by a similar respiratory virus carried out in the USA at the end of 2019, which would, according to estimation, claim about 65 million human lives, including a large number of infected prominent individuals and government officials.

Everyone will understand why the future belongs to microorganisms. While the health segment is being reorganized, the importance of molecular biology is becoming clearer, not only in characterization and genetic analysis, but also in diagnosis and treatment, as well as in the possibilities that the development of this science opens up for all possible abuses. The importance and roles of veterinary medicine and the CBRN service in such emergency situations are also recognized, as well as the need for a true multi-sectoral, interdisciplinary approach in solving such complex problems and fight against biothreats.

A fierce battle between globalists and sovereignists for supremacy within or between countries was taking place all the time in the background of the struggle against the virus. If we take into account the power of the media, the social networks and disinformation as a powerful weapon of hybrid warfare and their influence on the formation of an atmosphere of fear and panic as well as socio-psychological engineering and the inevitable drastic economic consequences at the world level, it is clear that infectious agents can be more effective than classical warfare and that the future of warfare certainly belongs to biological and other hybrid forms of war, as well as that it is necessary to prepare for them in a timely manner (Yadav, 2022).

1.3. Biological weapons: definition, main characteristics and using manners

The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxic Weapons and on Their

Destruction (BTWC), which entered into force in 1975, as the most important international document in this field, defines the term **biological weapons (BW)** as *"microbes and other biological agents or toxins, regardless of their origin or production manners, the possession of which is not intended for prophylactic, protective or any other peaceful purpose, as well as weapons, equipment and other means of dissemination of these agents for hostile purposes or during war conditions"* (BTWC, https://www.un.org/disarmament/biological-weapons/). In addition to microorganisms, some other, more flexible definitions of biological weapons include also insects, reservoirs, sources and vectors of infectious diseases, i.e. everything that does not belong to metals, fire and poisons.

By the way, the term **bacteriological weapon** was adopted during the First World War, but after the Second World War it grew into a broader term - **biological weapons,** which since 1947 has been classified as a **weapon of mass destruction (WMD)**. Today, the term **biological agent** (BAG) *includes microorganisms (bacteria, viruses, fungi, parasites) or their products-toxins that cause diseases in humans, animals, and plants*. **Biological warfare** *is the military use of biological agents with the aim of inflicting great losses to the enemy through artificially induced mass diseases of humans, animals and plants and by weakening of the war potential, i.e. armed resistance of the enemies* (DaSilva, 1999). Here we should also mention again the fact that biological losses can occur even without the use of biological agents, due to natural conditions and other factors, especially in the era of conventional war waging but also beyond that (e.g. Napoleon's war against Russia in 1812, modern wars, economic sanctions, etc.). **Biological attack** *means well-designed, spectacular covert attacks with biological agents directed against people, animals and/or plants* (USA, Department of Defense, 2016). Although not a single public biological war has been waged so far, there have been countless biological attacks during wars, but also in times of peace. In addition to the possible use of biological weapons in the interstate conflicts, there is a much greater danger of its using by various terrorist organizations, sects, and individuals. The term **bioterrorism** is defined as *"the use of violence using biological agents for political, religious, environmental or*

other ideological reasons, regardless of their moral or political justification". The contradictions of the modern world are the main cause of intolerance and conflicts, most often of a religious, racial and ethnic nature. In such circumstances, arise conditions for the application of the so-called "asymmetric method of warfare" because if he does not already have satellite-guided missiles, the poor (man, organization, state) will use what is within his reach and which he can produce and use in a relatively simple way, causing even greater effects in relation to modern weapons (Block, 2001). Pathogenic microorganisms fulfill all these conditions, and due to the unforeseeable consequences that their use can cause, they are labeled as the "*atomic bomb of the poor*". This wording should be understood conditionally and relatively, because everything depends on the scope of the potential (bio)terrorist action, as well as on who and for what purpose financially sponsors the bioterrorist organizations.

Agroterrorism is the intentional causing of plant or animal diseases, as well as designed attacks on food and water, using viruses, bacteria, fungi or toxins of living organisms with the aim of creating economic losses, fear and disrupting the internal stability of the attacked country. It can cause far greater consequences than direct effects on humans. Nowadays, agro-terrorism represents one of the biggest security threats, especially for predominantly agrarian countries. Agroterrorism is not a new danger, it has existed for a long time, but all the necessary conditions for its reliable proof have been achieved only with the development of microbiology and toxicology. Between 1951 and 1969, the USA already had stocks of three types of grain pathogens in its arsenal: 36,000 kg of wheat stem rot, rye stem rot and rice blight (900 kg) (Cirincione et al, 2005). A Department for the Development of Anti-Agrarian Agents was formed in the Ministry of Agriculture of the USSR. The **Foot and Mouth Disease virus** is very suitable for use in agro-terrorist activities. The epizootic of this virus in Canada from 1951 to 1953 killed 2,000 animals, while the direct costs of its suppression amounted to 2 million, and the indirect costs as much as 2 billion dollars. Epizootics in Italy and Taiwan in 1993 and 1996 both caused significant economic losses. In 2001, 6 million head of livestock paid the toll of a large

epizootic in Great Britain. The suppression of the disease lasted six months, and the direct costs it caused amounted to as much as 25 billion dollars. Indirect costs were 25 times higher, in the sphere of tourism alone they amounted to 350 million dollars per week. The total hysteria and the produced media effect significantly shook the industry of Great Britain (Feakes, 2017). **African swine fever** is an infectious disease that affects domestic and wild pigs and leads to high mortality rates. It was discovered at the beginning of the twentieth century in Africa, and then spread to Asia and Europe. It does not attack humans, but the consequences of this infectious disease are immeasurable. One of the key causes of concern is the potential ban on the export of meat products from the countries where swine fever has been detected, which could have incalculable economic consequences and potentially contribute to the famine appearance (Brown et al, 2021). Another characteristic of swine fever is the absence of a preventive vaccine and treatment process. The most common measure to control African swine fever is the euthanasia of sick individuals in order to stop the spreading of infection. In this regard, the allegations about experiments with this virus carried out in biolaboratories in Ukraine and in the post-Soviet space are extremely worrying.

In recent times, the current threat is certainly the (mis)use of genetically modified crops or herbicides, and the focus of interest is the so-called "terminator technology", which implies genetic modifications of plants by reducing their fertility, which creates permanent profit for producers (Ristanović, 2009). As a weapon of agro-terrorism, it is also mentioned the possibility of controlled influence on climate change, that is, on atmospheric conditions that are particularly significant in certain stages of the development of plant crops (germination, flowering, ripening, etc.). This form of agro-terrorism can only be applied by economically and technologically developed countries.

A special danger today is the intensive development of molecular genetics and biotechnology, whose achievements, in addition to serving the benefit of humanity, can also be misused (Beauchamp & Childress, 2001). That is why, taught by the experiences of earlier periods, many believe that biological weapons and bioterrorism can be, not only the atomic bomb of the poor, but also a

dangerous weapon in the arsenals of the most powerful states and governments, which could use it to realize their goals (Block, 2001).

In order to complete the conceptual definition of bioterrorism, we must not skip the term **biocriminal act**, *which includes any possible abuse of biological agents, i.e. criminal acts of illegal production, theft, resale and use of biological agents for purely material reasons* (Carus, 2001). Based on all of the above, it is indisputable that bioterrorism is actually one of the most brutal forms of terrorism that is often aimed at the innocent and unprotected population, as well as polluting and contaminating the environment, with the aim of causing fear and panic, i.e. endangering the health and life of people, plants and animals. The consequences of bioterrorism are very dangerous and unpredictable in scope, from the achievement of tactical to the strategic goals. The term **biological defense** *refers to comprehensive methods, plans and procedures for establishment and implementation of defense measures against possible biological attack.* Due to the reality of the threat of bioterrorism and misuse of biological agents, as well as the possible consequences of such actions, biological defense must be clearly defined within national security strategies (DaSilva, 1999). Today, biological threats are clearly recognized in the national security strategies of the most powerful actors on the world political scene, and they are also recognized by collective security organizations (UN, OSCE, NATO, CSTO). After all, from the aforementioned anthrax campaign until today, weapons of mass destruction, including biological ones, have been set as a red line for the beginning of all war conflicts that have been fought in the latter period (Козин, 2016).

Significant human casualties, psychological effects, the destruction of animal and plant life, as well as the consequent generation of hunger, environmental threats and economic losses are just some of the possible consequences of the very likely use of biological weapons in future wars or terrorist actions (Eneh, 2012). Interest among terrorists in the matter of these weapons undoubtedly exists, the number of possible perpetrators, state and non-state actors is growing, and many such groups have powerful international networks. Today, the technology for the production of biological weapons is

conquered and easily accessible, the genome sequences of many microorganisms as well as scientific information about them can be found in the literature and on the Internet, there are also a large number of laboratories whose work is not always fully understood and controlled (Minogue et al, 2019, Steinberger et al., 2008). The methods of application, scope and effects of such actions would certainly depend on the size, organization and financial capabilities of their potential implementers, so the greatest effects would certainly be caused by those terrorist actions provoked by the organizations that would have the possibility of using a modern arsenal of biological weapons, as well as the technology of its production and dissemination (CIA, 2003).

Nevertheless, considering the long history of the use of biological agents and despite the constant and numerous public and legal condemnations of such actions, the question arises as to what makes biological weapons attractive to those who want to use them. Answers to this question should be sought in the following factors: **simple production** (for the production of large quantities of some types of biological agents for the simplest terrorist use, modestly equipped microbiological laboratories are sufficient, which should have nutrient media for the propagation of cultures of microorganisms, incubators-thermostats and experts with basic knowledge of microbiology) and **cheap production** that actually results from the previous one (some estimates say that the costs of "neutralizing the living force" on an area of 1 km2 with the use of conventional weapons would amount to about 2000 dollars, nuclear - 800, chemical - 600, while with the help of biological weapons the same effect could be achieved for only 1 dollar; here, of course, we do not think about the use of highly sophisticated biological weapons, nor the means for their application); **covert application** - with the knowledge about the epidemiological, epizootological and ecological situation in a certain area, the use of biological weapons can cause a disease on a smaller or larger scale that is impossible to distinguish from a naturally occurring epidemic (Enemark, 2010); the difference can only be established with molecular-genetic typing and identification of autochthonous strains and the causative agents of the epidemic, but this is not always possible; **high efficiency** - according to a very old

WHO estimation, from 1971, the release of 100 kg of anthrax spores in the form of an aerosol on a city of 5,000,000 people would cause the death of up to 3,000,000 people, which would represent the equivalent of a hydrogen bomb. With 1 kg of anthrax spores, disseminated in the form of an aerosol, can be covered an area of 100 km² and it can cause the death of 50% of people there. Today, in the era of genetic engineering and biotechnology, the effects of such an application would be much more dire (Ristanović, 2015a). There is also a **specific effect** on people, animals or plants, causing of mass illness-death depends on the type of biological agents and on the method of their application (the most suitable are agents that can be disseminated through aerosols and with a possibility of subsequent interhuman transmission such as i.e. smallpoxvirus), without causing great material damage and destruction of infrastructure objects as well as problems related to the 1) **rapid detection of the attack and identification of the applied agents**, 2) **establishment of adequate measures to neutralize the biological attack**, 3) **adequate treatment of the sick and prophylaxis of the healthy-exposed**, 4) **causing panic, fear, political instability, disruption of health and other services and disruption of normal activities with all the resulting consequences.** All previously mentioned require the existence of adequate and qualified human and material resources with clearly defined competences, obligations and tasks of all subjects in a given situation; (DaSilva, 1999).

We should here certainly mention the limiting factors related to the use of biological weapons, such as: **unpredictable effects** and **the impossibility of complete control** with the possibility that the one who uses it becomes its victim *("boomerang effect")*; **dependence on the environmental conditions** (climatic and meteorological conditions (temperature, humidity, wind, precipitation), geographical position, configuration of the terrain, contamination of the population with certain pathogenic agents, etc.); **dependence on experts** (biologists, molecular biologists, doctors of various specialties, veterinarians, physicists, meteorologists, weapons experts and others) in deciding on all essential elements of the use of biological weapons because some agents, for

example, are difficult to obtain (smallpox), difficult for production (plague), they must be used in large quantities (ricin), there could be many difficulties in their turning into weapons, the maintenance and storage must be adequate, and application, i.e. dissemination of such weapons requires a lot of expertise; **the lack of information about experiences in the use of biological weapons** in order to make an adequate assessment because such activities are usually kept in strict secrecy and it is not always easy to connect the appearance of diseases in the event of a possible bioterrorist attack with the epidemiological surveillance and monitoring of infectious diseases, especially if it is used a combination of several different agents or some new, unknown or genetically modified agents (Salerno et al, 2004; Enemark, 2010).

All pathways of infectious diseases transmission in natural conditions can also be used in the application and dissemination of biological weapons. **Transmission via aerosols** is, of course, the most effective way, because the largest number of people, animals or plants can be infected through the air. Airplanes (aero-spray) or spray from the ground, unmanned aircraft-drones, explosive bombs with infectious material packed in porcelain shells, rockets of various ranges can be used for this purpose (Joshi & Stein, 2013). Aerosol dispersion systems are adapted to create a cloud of invisible droplets, usually 0.5 to 10 μ in diameter, which can remain suspended in the air for a long time. Large particles fall faster on the ground contaminating with the possibility of creating the secondary aerosols. The physiological process of breathing enables the continuous agents entering into the body, and people are thus cumulatively exposed to them. Particles with a size of 20 microns (μ) can infect the upper parts of the respiratory tract, but these particles could be usually removed by physiological processes, while smaller ones (size 0.5 to 5μ) easily reach the alveoli where they exert their maximum effect. Respiratory-aerosol transmission can cause illness with a lower dose of agents than in a naturally occurring infection, the clinical picture can be also changed, while the incubation period could be usually much shorter. For bioterrorist actions, could be used the creation of aerosols using sprays, as well as air conditioning systems in larger and

modernly equipped buildings (Edwards, 2002). Some agents are rapidly inactivated after dispersion, and some can be carried by wind over long distances. Agents adsorbed on dust particles have the ability to survive for a long time and can be resuspended into the air from contaminated surfaces.

Water as a way of dispersal of biological agents can also be an effective means, especially across the water-supplying systems of large cities or even the watercourses of rivers. **Food** can also be used, but with somewhat less effectiveness, because the number of exposed people in such situations is generally smaller compared to the number of water users. The causative agents of intestinal infectious diseases could be also dispersed through the food as well as via the water. Nowadays, genetically modified food (GMO) and its potential abuses bring new opportunities in this context. There is a possibility of dissemination of pathogenic agents through **biological vectors** (fleas, lice, mosquitoes, ticks) and reservoirs (e.g. bats, birds, rodents), but this method is the least suitable due to unreliable effectiveness and the impossibility of controlling its effects. **Intact skin** is an excellent barrier for many microorganisms. If the skin or mucous membrane is damaged, infectious agents can more easily penetrate the body, causing local and/or systemic infections. Certain types of causative agents can subsequently be transmitted **through contact with infected persons** (secondary cases), which contributes to the further widespread of the disease. Persons who do not know that they are infected with highly contagious agents (the causers of smallpox, plague, Ebola, etc.) can be a significant source of infection. Therefore, special attention should be paid to the migration of the civilian population (displaced persons and refugees). A more recent "invention" of the distribution of biological agents is via **mails (letters)**, as it was done in the USA in 2001 (Ristanović, 2015a).

Although all pathogenic microbes and their products-toxins can be used as biological weapons, the following characteristics are especially important in their selection for this purpose: *low infectious dose, high contagiousness, high lethality, possibilities of simple production and storage, persistence of pathogenic properties and causing of corresponding consequences, the existence of multiple*

ways and routes of dissemination and infection, resistance to the external environment, difficult detection and identification, sensitivity of the target population as well as the impossibility of self-protection (Primmerman, 2000). In order to take into account all of the above mentioned, it is necessary to know the microbiological, genetic, antigenic, biochemical characteristics of the pathogens, the mechanism of immunopathogenesis, as well as the genetic and immunological characteristics of the target population.

Toxins of biological origin are toxic / poisonous substances derived from living organisms – plants (ricin) and bacteria (botulinum toxin, *Clostridium perfrigens* toxins, staphylococcal enterotoxin B), fungi - mycotoxins (aflatoxin, ochratoxin, trichothecenes, rubratoxin, etc.), marine animals (saxitoxin, tetrodotoxin). They can be also obtained by chemical synthesis or in a suitable vector, through genetic engineering (Casadevall, 2017). The effects of *botulinum toxin* are 300 times stronger than the effects of the most toxic military chemical poison. The lethal dose of botulinum toxin is only 0.001 mg per 250 kg of the body weight, while the lethality of the most modern nerve agent is as much as 15 mg per kg of body weight. Just the one gram of the botulinum toxin in a crystalline form can kill about 10 million people. It was used in Vietnam to poison local sources of food and water, when it was entered directly, in the form of an aerosol, into prison as well as refugee camps. More than 10,000 people were poisoned by sabotage methods, while frontal attacks were carried out by aerosol contamination through a mechanical aerosol generator. The incapacitating dose for humans is 0.001 mg, and the mean lethal dose is 0.02 mg/min/m3 of air (Rossow et al, 2012). *Trichothecenes* are very stable. In the case of possible intentional application, they could be used through contaminated water and food or through aerosols. Trichothecenes, unfortunately, became known to the general public only after their detection in samples of the so-called "yellow rains" in Southeast Asia, when these mycotoxins were used as weapons in the Vietnam War (Casadevall, 2017). Toxins have characteristics of both chemical and biological agents. They can be used as weapons for strategic and tactical operations, and present ideal mean for covert use in terrorist actions. Saboteurs

can contaminate with toxins the ventilation systems, drinking water, and food sources, causing heavy casualties.

Classification of biological agents is important for identification, prophylaxis and treatment. Their detection and identification is carried out in laboratories that are also classified into different categories depending on the level of equipment and biological safety conditions (protection levels 1, 2, 3 and 4) for working with material and agents of different degrees of contagiousness. It should also be borne in mind that biological agents can be genetically modified in order to make their detection and application of appropriate medical countermeasures more difficult (Daneluan & Gulyaeva, 2022).

Biological contamination is the presence of pathogenic microorganisms and their toxins in space, living beings or the atmosphere, after a biological attack. The territory where the biological attack was carried out is called *the zone of biological contamination* and it depends on the type of agent used and the method of its application, the soil, climatic and meteorological conditions, as well as the effectiveness of the implementation of decontamination measures. The boundaries of the zone of biological contamination are more difficult to determine than the boundaries of radiological and chemical contamination (USA, Department of Defense, 2016). Contamination of the atmosphere is carried out by the application of *biological aerosols* to intentionally cause infections in humans, animals or plants. Contamination is carried out by dispersing bioaerosols in the ground atmosphere. Large areas can be contaminated with small amounts of bioaerosols that can be directed at the target by rocket missiles whose warheads are filled with biological agents or bioaerosol generators. Protection is very complex and less effective in such circumstances, because biological agents are spread by air currents or by ventilation devices in a closed room (Edwards, 2002). In recent times, more and more unmanned aircraft-drones that have canisters for growing, transporting and releasing of infected vectors or the infective agents in the enemy's airspace are being developed, as well as bullets with capsules containing deadly pathogens and many other new ways and technologies of bio-agents applying (Joshi & Stein, 2013).

Since covert sabotage-terrorist attacks are the most probable form of biological warfare in modern conditions, the primary targets of these would most often be drinking water and food. It is supposed that the agents in the form of powder, liquid or aerosol would be used in such circumstances. Food, as it is already mentioned, is an excellent medium for the reproduction of microorganisms. Milk and milk products, raw meat, bread and pastries, as well as all food that is not subject to thermal and chemical processing, are very convenient for contamination, which would most often be done using vials or ampoules with freeze-dried microorganisms, and less often aerosols or contaminated vectors. Secondary contamination would occur after processing food with contaminated water or preparing it on contaminated surfaces. Biological soil contamination occurs primarily in the case of open bioaerosol attacks (Edwards, 2002). The duration of contamination in all the mentioned situations depends on the type of used pathogens. Contamination of the living force can occur through inhalation, via alimentary route, through the skin and mucous membrane, as well as through biological vectors. Therefore, based on the above, it is clear that the means and methods of applying biological agents can be all combat systems, with minor or major adaptations, namely: agricultural and combat aviation, even civilian aircrafts, missile and artillery combat systems, drones with specialized canisters for biological cargo, including aerosols, with volumes of 20-30 liters and long ranges (up to 300 km), hand and portable sprinklers, as well as postal items, sprays, household utensils, personal hygiene products, souvenirs, toys, human and livestock food, juices, fruits and vegetables, diseased or inoculated animals, birds, insects, infected humans, and GMO organisms.

According to the estimates of UN experts, in the case of biological attack with bioaerosols using aerial bomb, on a city whose population would be unprepared, surprised and unprotected, the zone of effect of a biological attack would be up to 100,000 km^2. The time of appearance of the consequences would depend on the duration of the average incubation and, as a rule, would last several days. The destructive effect would be absent, while the specific effects would be

reflected in the appearance of biological contamination of the atmosphere, soil, water, food, objects and surfaces. The possibility of possession of the invaded territory by the aggressor would be limited by the duration of the average incubation period. The maximum possible effects of such an attack would reach the figure of 80% infected people, 60% sick and 30% dead in the primary biocontamination zone (Edwards, 2002).

The strategy and doctrine of biological warfare conducting has changed several times in recent history. In the fifties of the 20th century, biological weapons were treated as tactical and sabotage-terrorist weapons for action in the deep background of the attacked country, while in the following decade it gained strategic importance in the concept of modern wars conducting, using biological agents in the form of bioaerosol in order to achieve total contamination of the atmosphere.

After the Biological Convention entered into force in 1975, new programs for biological weapons production and development were conceived, as well as new doctrines and strategies of biological warfare (Mair & Mair, 2006). Intensive development of biological weapons continued under the guise of anti-biological protection, and the same was applied in special wars, local wars and terrorist actions.

The next phase of international relations began with the end of the bipolarity phase and the Cold War. At the global level it was characterized by the dominance of one superpower and by the appointment of the so-called "bad countries" as a threat to global security, due to, among other things, the WMD they are supposed to possess. Although the fact was not proven, it was used as the formal reason for some wars and attacks to those countries (CIA, 2003).

It seems that a new phase of international relations has already begun and the world is soon moving towards multicentricity. In those changes we are witnessing, the biological threats and impacts of biological weapons have been actualized again.

Although biological weapons can be combined with other types of WMD, as well as with conventional weapons, it is considered that the military use of

biological weapons in the actual zone of operations today would represent an unlikely possibility, while the use of biological agents in a special war, a low-intensity level conflict, in sabotages and terrorist actions as well as covert application in crisis situations, in times of relative peace, would be more realistic (Surlova, 2022). The same would be directed primarily towards the civilian population, plant and animal life, while the armed forces would be in the second plan. Covert and insidious application of biological agents would be effective in the achieving goals of crises aggravating, destabilizing the system and weakening the military potential of the enemies.

1.4. Prevention and fight against bioweapons

Protection against the action of biological agents implies, first of all, the coordinated action of the intelligence-security and health (medical-veterinary) sectors, the police, the army, as well as other subjects of society in accordance with their specific tasks and defined roles (Rode et al, 2010). In the prevention of biological attack, a particularly important role is played by appropriate intelligence and security services, which are engaged in the collecting of data about the intentions of the enemy, the possible location and time of use of biological weapons, as well as the types of biological agents (Petro, 2004). The constant epidemiological surveillance of infectious diseases and the health of the population, as well as the improvement of personnel and material resources in this area are of crucial importance for adequate prevention and response in the event of a possible bioterrorist act. However, considering the character and specifics of the bioterrorist act, it is most realistic that the protection will be carried out post-exposure. The most important measures in this case are: recognition of the biological attack, detection and identification of biological agents, treatment of the exposed as well as biological decontamination (Gigi, 2012).

Probable biological aggression can be indicated by a sudden or unexpected occurrence of frequent illness and/or death that is not related to the previous epidemiological situation, simultaneous infection of patients with two or more

pathogens, which can complicate or delay the establishment of a diagnosis, unusual geographical occurrence of an infectious disease, occurrence of seasonal diseases at a time when they are not usually registered, the appearance of unusual disease manifestations, frequent illness and death of animals, as well as the evidence of contamination of air, water, and food (finding remnants of bombs, equipment and means for contaminating water and food, intelligence data) (Ryan, 2016).

The basic problem that needs to be solved in the case of a sudden disease onset is whether it is a naturally occurring disease or a consequence of biological attack. This sometimes could be a big challenge because a potential attacker can use all the epidemiological and ecological circumstances in a certain territory to make difficult or impossible to recognize a biological attack (Enemark, 2010). The disease that occurs after a biological attack can have different clinical manifestations compared to a naturally occurring infection. Therefore, knowledge about the epidemic process of a particular infectious disease is extremely useful in distinguishing of natural epidemics from biological attacks. When a biological or combined attack is suspected, it is necessary to determine as soon as possible the way and path that led to the emergence of the infection in order to establish effective control measures (Kallenborn & Bleek, 2018). Rapid detection and definitive identification of suspected biological agents are of primary tactical, political, forensic and medical importance. It is essential that the personnel who collecting the material must be trained in proper sampling, transport and personal protection (Primmerman, 2000). Samples of biological material and the environment may contain highly pathogenic agents, so their handling and transport to the laboratory should be in the accordance with the regulations on biological safety as well as national and international regulations on the transport of such material (Eneh, 2012). In assessing of the possibilities of microbiological laboratories for work on the biological agents identification, in addition to diagnostic competence, the existence of appropriate conditions for the protection of personnel and the environment has a decisive influence, i.e. the appropriate level of biological safety and biological security, and above all the training and

expertise of the staff and the possession of adequate equipment and reagents (Atlas & Dando, 2006). Diagnosing of diseases in the area of action of biological agents can be extremely difficult. If there are indications about the presence of a highly contagious causative agent, strict isolation measures are implemented for the sick or suspected people as well as the staff who take care of them. A specific measure of anti-biological protection of healthy persons in the event of a bioterrorist threat or attack is prophylaxis, which can be pre-exposure and post-exposure. It includes the use of vaccines, specific immunoglobulins (immunoprophylaxis), antitoxins and antimicrobial agents (chemoprophylaxis). That is why it is important to develop and support scientific research capacities and resources for their production. Physical protection in the case of biological attack can be personal and collective. Biological decontamination includes measures and procedures that remove or neutralize pathogenic microorganisms to the point of eliminating the risk of infection. It can be partial or complete.

Prevention and preparation for an adequate response in the event of agro-terrorist acts directed at the food supply require a stable and strong public health infrastructure, disease surveillance, fast and reliable laboratory diagnostics, as well as the development of hospital capacities. Therefore, the development of the potential of national logistics and response strategies for the spreadings of epidemics of infectious diseases in plant and animal populations with clearly defined tasks and obligations of each service is also an imperative of today's time (LeClaire & Pitt, 2005).

The social and psychological effects of the action of biological agents are well known in history, throughout the centuries, from the time when the plague, leprosy, smallpox and other infections ravaged civilization, until today's emergence of Ebola, HIV, swine flu, COVID-19 and other diseases. These effects are primarily the consequences of the fear from unknown diseases and their potential consequences. Bioterrorism as a phenomenon that includes the joint action of terrorist threats and infectious diseases opens a special chapter related to the psychological consequences and effects of actions that in themselves can represent the goal of potential terrorists. In any case, knowledge and information

about the biological attack can lead to mass hysteria as well as behavioral disorders that occur as a result of fear, panic and insecurity, all of which would require an urgent response of the experts in the field of psychology and mental health (Block, 2001). In such circumstances, withholding of information can be counterproductive, as rumors and confusion spread quickly. In the each zone of restricted movement, it should be possible to carry out and maintain life and other activities with appropriate logistical support in the supply of food, water, sanitary protection and a place for waste materials disposal. Nowadays, due to the activities of the civil sector, various informal groups and individuals, as well as media manipulations, there may be various misinformation related to the implementation of quarantine measures, which should also be taken into account (Szalados, 2012).

In the time we live in, media, communications and social networks shape the world and people's consciousness, information (as well as misinformation) are obtained and transmitted incredibly quickly, and the media often arrive at the scene before the appropriate services. The media is also of great importance for terrorists, because through them they provide themselves publicity, communicate their messages, demands and goals. Crisis communication is only a part of the overall strategy of relations with the public, which must be carefully built by paying full attention to it, especially in this day and age. In any case, relations with the public in crisis situations caused by a potential bioterrorist act must be directed towards different target groups, namely: employees in public services, injured/diseased/exposed population, vulnerable population, domestic and international public. For all mentioned groups, it is necessary to use various communication tools and methods. Crisis communication must be only part of a unique, pre-developed and practiced crisis management and integrated multisectoral response with defined obligations and tasks of all subjects (Wrigley et al, 2003).

International cooperation and communication are extremely important here, because microorganisms and their spread do not stop at the administrative borders. It is important to provide vulnerable countries with adequate help and

support, from logistical to medical, as well as with knowledge and experience, which leads to the development of a new branch - medical diplomacy. The experience of COVID-19 has actually shown the great hypocrisy of the self-centered countries of the political West, as well as the selfless openness to help and support provided and showed by Russia and the People's Republic of China (Данельян& Гуляева, 2022).

1.5. BW: disarmament and other control regimes

Taking into account everything previously said, it is clear that the covert, deliberate and planned misuse of biological agents has a long historical continuity. Nevertheless, it can be said that earlier in the history biological means and methods were abused exclusively before or during the wars. The thinking that this way of warfare was shameful had matured already in the age of the Roman Empire. So, even then there was awareness about the harmfulness of these types of "weapons" and the consequences they could cause, and that is why in 1675 was signed **the French-German agreement** on the "prohibition of the use of toxic weapons". However, only from the end of the 19th century, with the intensive development of knowledge in the field of microbiology and epidemiology, the fear of using pathogenic bacteria as a weapon began to grow, so into laws were introduced provisions prohibiting their use in war (Leach, 2021).

Due to the terrible consequences of the use of biological and chemical agents in the First World War, the League of Nations, the forerunner of the UN, adopted **the Geneva Protocol** in 1925, which prohibited the use of chemical and biological weapons, as inappropriate for modern civilization (Moore, 1972). However, since the protocol did not prohibit possession, but only the use of such weapons, work on their improvement was continued and intensified, especially during the Cold War period.

In 1969, the USA announced a decision to abandon unilaterally the production of biological weapons and destroy the stocks of biological agents and their toxins. The USA finally signed and ratified the Geneva Protocol and

supported Great Britain's initiative for adoption of the **Convention on the Prohibition of the Development, Stockpiling, Acquisition and Transfer of Biological Agents and Their Toxin.** As it was mentioned, this Act was adopted in 1972 and entered into force in 1975 (BTWC, https://www.un.org/disarmament/biological-weapons/). So far, this Convention, which has 15 articles, has been ratified by 184 countries, ***but under the auspices of the UN has never been constituted an international body to deal with the control of the implementation of the Biological Convention***, whose signature depositories were the USA, Great Britain and the USSR. Failure to comply with its provisions is considered as a crime against humanity (DaSilva, 1999).

Each Convention member state has undertaken to never, under any circumstances, produce, refine, stockpile or otherwise acquire or store:

(1) microbiological or other biological agents or toxins, regardless of their origin or method of production, which by type and quantity are not intended for use for prophylactic, protective or other peaceful purposes;

(2) weapons, equipment, or vectors intended to use such agents or toxins for hostile purposes or for armed conflict (BTWC).

Despite the proclaimed positions and assumed obligations that must be translated into national legal measures and control mechanisms, after the signing of the Convention, not a single known factory was destroyed either in the USA or in the USSR, personnel were saved, and research continued in "defensive purposes".

Many items and terms from the Convention remain unclear and vague (Dunworth et al, 2006). Thus, the Convention does not mention an explicit ban on the use of biological weapons, the term "peaceful purposes" is not clearly defined, as well as the amount of biological agents that can be possessed for the purpose of carrying out activities "permitted" by the Convention. The BTWC prescribes only the obligations of states with regard to biological weapons, but not the obligations related to facilities for their production and activities that are not prohibited, which distinguishes it from the Convention on Chemical Weapons.

A serious deficit is also represented by the fact that the measures of national control (self-control) form the basis of the system of supervision over the implementation of the Convention, while the international control is very scarce, which actually brings this document under the framework of a gentleman's agreement rather than a binding international act (Beard, 2007). It is true that under the auspices of the UN every few years are held the Review Conferences, where potential problems are discussed as well as the level of legislation development, while there is not a single international supervisory body or authority in charge of controlling the implementation of BTWC. Negotiations on its constitution were interrupted in 2001.

The Convention on Biological Weapons, it is true, foresees some measures for implementation on the international level, namely: (a) consultations and cooperation of member states, which also take place through conferences where all problems and the level of legal regulations in individual countries are discussed, and (b) submitting of complaints to the UN Security Council (BTWC, https://www.un.org/disarmament/biological-weapons/). Although the problem of the lack of verification measures was noticed a long time ago, all previous attempts to amend the Convention in order to improve its efficiency have been unsuccessful or have been undermined by planning, and it can be said that in recent years there have been significant disagreements between the contracting parties regarding the procedure and methods for the strengthening of verification measures (Drobysz, 2020).

A step in that direction, in terms of universality and binding nature, was to some extent represented by **United Nations Security Council Resolution 1540 (UNSCR 1540)** unanimously adopted on April 28, 2004. This Resolution refers to the prevention of the proliferation of weapons of mass destruction (chemical, biological, radiological, nuclear) and much more precisely defines the obligations of all states in the context of developing and improving appropriate legal and regulatory measures against the proliferation of WMD and the means for their application and dissemination, apostrophizing in this context the use of WMD by non-state actors (Kelle, 2022).

It also emphasizes the importance of continued talks on non-proliferation and disarmament and ensures the establishment of the **1540 Committee** to oversee the implementation of the Resolution, as well as all additional financial, security and physical aspects of protecting sensitive materials, including border and export controls. Although the Resolution is in theory binding for all UN members and is based on the implementation of Chapter 7 of the UN Charter, it was nevertheless decided that the process of its implementation should not be based on coercion, but on mutual cooperation. It should also be said that the possibility of terrorists getting possession of WMD was previously discussed in **Resolution 1373** of the UN Security Council, which was adopted after the anthrax campaign in 2001 (Edwards et al, 2022).

The issue of protection against biological threats is also treated by national legislation in the field of protection against infectious diseases, environmental protection, as well as within the control of dual-use goods, through numerous international regimes, including the most important in this sphere, the so-called **Australian Group (AG),** an informal forum of countries that, through the harmonization of export controls, strive to ensure that the export of goods does not contribute to the development and use of chemical or biological weapons and that the transport of sensitive substances that can be misused for these purposes takes place according to clearly defined rules. Coordination of national export control measures helps AG participants to fulfill their obligations under the Chemical Weapons Convention and the Biological and Toxin Weapons Convention to the greatest extent possible (Kelle, 2022).

These are only some of the valid regulations for the control of something that cannot be absolutely controlled in practice, because biological agents are found in nature, and people's consciousness and knowledge, as well as motives, nevertheless represent a zone in which it is not possible to establish complete control (Hersman et al, 2022). **However, this does not diminish the need for revitalization and strengthening of the advisory, independent and executive role of the UN in monitoring and implementing protection from this global threat and establishing an objective multidisciplinary international body that**

would deal with this problem, which is gaining more and more importance in the current geopolitical reality.

2. PROBLEM, SUBJECT AND GOAL OF RESEARCH

2.1.The problem of research

The history of human society, and especially the current moment in which we live, unequivocally shows and proves the long-recognized fact that biological weapons possess characteristics that, in certain circumstances and situations, make them a very suitable tool for violently achieving the certain goals. It actually represents an ever-present infernal device, which can be activated at any moment, because the attractiveness of this tool is so great that it makes its use quite realistic, regardless of the severity of the conviction (crime against humanity) and other consequences, and it can be expected that and in the future someone, sometime and somewhere will use it to achieve the desired effect. Therefore, the danger of using biological weapons should never be ignored, especially at a time of explosive development of life science, as well as corresponding technological progress. The problem is also the fact that biological agents can be seen as a security threat from the aspect of bioterrorism, epidemics and pandemics that can be naturally or artificially caused, climate change, migrations... Despite the fact that microorganisms are present all around us, the process of turning them into effective weapons is not simple and quick. Therefore, any biological research must be subject to appropriate control and regulation at the national and international level, just like the possession and transfer of the so-called dual-use goods, which include microorganisms themselves, as well as equipment that could be used for their propagation, purification, transformation into weapons, testing and development of means for potential dissemination (national control lists of weapons, military equipment and dual-use goods, Australian Group Checklist and numerous other regimes) (Hersman et al, 2022). The Biological Convention represents the highest and most comprehensive multilateral regime for the control

of potential biological weapons within the UN security system, which opens wide opportunities and imposes numerous obligations on signatories, but it lacks impartial enforcement mechanisms of monitoring and verification, at the international level, founded on the highest comprehensive expert knowledge in the domains of biomedical sciences, security, technology, physics, military sciences and other fields (Gerstein, 2013). Due to all of the above, the issue of this research is nowadays a big challenge, bearing in mind that the political will of the most powerful actors on the world stage, and the awareness of other international actors and countries is a necessary prerequisite for a responsible approach to this complex problem.

2.2. Subject of research

Based on the theoretical setting of the research problem, the subject of this research is defined. It refers to the existence of a real risk and threat of using biological weapons in low-intensity conflicts, terrorist acts, interstate and internal conflicts, causing of epidemics and pandemics, as well as far-reaching consequences for human lives, environment, economy, security. There is also a risk of the uncontrolled spread of technologies, knowledge and information for the production and use of these weapons, as well as serious deficiencies in the implementation of impartial, expert verification and control mechanisms within the UN security system that often depend on the most powerful actors on the world stage (Edwards et al., 2022). In this regard, the observed shortcomings within the Biological Convention, especially the responsibility for its observance and application, which is to the greatest extent on the signatory states and their own resources in monitoring the compliance of measures and control regimes with the provisions of the convention, which are not based on realistic assessments. They are often carried out under the influence, pressure, but also in accordance with the scientific, technological and intelligence-security capabilities of the states themselves (Walsh, 2018), and above all with the level of knowledge and awareness of this problem that exists among experts, as well as decision

makers. All that mentioned, today imposes the need for a completely new approach and thinking about the structures and actors involved in the implementation of the provisions of the Convention, as well as the need for constant improvement and strengthening of measures to control and prevent the proliferation of potential biological weapons (Hersman et al, 2022). Intensive and close international cooperation and effective true multilateralism, as well as reference to the objective postulates of science that would not be subject to political manipulation, would be a true contribution to international peace and security. Based on that, it can be concluded that the subject of research is extremely actual at a time when biological threats represent one of the leading security challenges.

2.3. The aim of the dissertation

In accordance with the established starting points and the subject of the research, the goal of the research was defined, as a comprehensive understanding of the problems and dimensions of the current security threat represented by the potential use of biological weapons and its consequences primarily in the context of health, environment, but also international security, the economy, as well as the achievement of war objectives, through an examination of the current mechanisms of its control, prevention of proliferation and usage, within the framework of multilateral control regimes, primarily the Biological Convention, its shortcomings and the necessary need to strengthen independent control and verification mechanisms including the formation of an expert international body under the jurisdiction of the UN, which will lead to the strengthening of their role in preventing the use of biological weapons and represent an essential contribution to international peace and security.

2.4. Research questions

The problem is not new, but in the present moment of major geopolitical milestones, it is happening in real time. The implications of COVID-19, as well as many other facts and experience show that the problem has its own dialectics and dynamics throughout the course of history. Thus, the approach to this research must be different from the usual hypothetical-methodological framework and it is designed according to the **type of exploratory research**, which includes setting of research questions which will be answered by further research.

Starting from the subject and goal of the research, the following research questions and tasks were defined:

a) What is the current international regulation within the UN security system on the control of the non-proliferation of biological weapons? Can its shortcomings be critically viewed and how can they be reflected in failures in the control of the proliferation of biological weapons?

b) Is it possible to see the lack of verification measures and ways to overcome them? In this sense, how significant would it be to form an independent expert body under the monitoring of the UN - *Organization for the Prohibition of Biological Weapons* with broad executive powers and what kind of resistance would it encounter? Why wasn't such a body formed earlier, as happened with chemical and nuclear weapons?

c) To what extent is it possible to abuse the explosive development of science, especially in the domain of bio-medical and technological disciplines (biotechnology, genetic engineering, nanotechnology)? Are ethical principles or legal regulations important in this domain? Could knowledge transfer be controlled?

d) How the free movement of people, information, goods, commodities, services and capital increases the availability of potentially dangerous substances and creates a potentially suitable environment for increasing the likelihood of misuse of dual-use commodities, i.e. unauthorized transfer of technologies by groups, non-state actors or individuals in order to develop and use WMD as a transnational asymmetric security threat and its use as a threat to international peace and security? What are the specifics of biological, in relation to other types of WMD, to which special attention must be paid in this case and is it possible to establish a control regime there?

e) What is the role of the intelligence and security apparatus in the prevention of biological threats, with a special emphasis on MEDINT as an important tool in the fight against biological threats and strengthening of the biological security?

3. RESEARCH METHODOLOGY

3.1. Kind of research

Exploratory research, descriptive, predominantly qualitative (Ristić, 2016) and critical analysis of the contents of publicly available, official and published data and scientific works, as well as publications of institutions that could achieve the formulated goal of the doctoral thesis in a clear, scientific and unambiguous way and provide answers to set research questions.

3.2. Data type selection

The research used data from existing secondary sources, documents and scientific works, past experiences and specific case studies, which are the richest in data and related to the complex problem that we tried to understand with this research. The partial openness of the scientific bases due to the topicality of the problem and the active pandemic of COVID-19, also enabled us to access the latest

relevant literature in the fields of medicine, economics and security, i.e. different aspects of looking at the problems and consequences of the possible use of biological weapons.

3.3. Method of sampling and sample analysis

Data sources include official information published on verified websites, by international and national policy makers, available official scientific and professional literature from scientific databases (Ristić & Balaban, 2006), as well as information and interpretations available via the Internet directly provided by experts and decision makers from different countries (Steinberger et al, 2008). In accordance with the expediency of the research, the available data were carefully selected and critically analyzed, since due to the sensitivity and dimensions of the research problem, the area of placing information sources is susceptible to manipulation, so, in addition to critical and objective scientific analysis, it was necessary to take into account the credibility of the available sources (Johnston, 2017). This is exactly why it was made a careful selection of literature and information sources. In accordance with the topic of the work, the selection of the most appropriate data management procedures was made, as well as the procedure of qualitative data analysis, which was taken into account with the subject of the doctoral dissertation, that is, the posed questions and the analyzed phenomena.

3.4. Assessment of the research importance and the topic relevance

The relevance of the topic is unquestionable and dictated by the reality in which we live. The research process was carried out by analyzing data from reliable sources and previously partially completed research, which could be logically brought into the context of the research topic. Based on them, it was proven the mutual connection and impact on the health, psycho-socio-biological, geopolitical and security environment, as well as the necessity of a new policy and an innovative way of thinking and acting in all spheres on the national, regional, and

especially international framework, in accordance with the new security challenges of the time. It is to be expected that the topic will be more pronounced, the security agenda will be more and more complex, and therefore this dissertation and its subject matter will confirm their relevance in the times to come.

3.5. Limitations/weaknesses of the research and open questions

The sensitivity of the moment in which the research is carried out, as well as the limited availability of information and its different interpretation in real time, set various limitations and difficulties in interpretation and analysis, but also gave it special importance. In this regard, this research presents a special challenge. The research is limited to publicly available and published data.

4. RESULTS AND DISCUSSION

4.1. **International legal framework of the fight against biological weapons**

The use of poisons and pathogenic agents in war has always been considered an unworthy practice and way of warfare, and accordingly it was condemned by international declarations and agreements, such as the Hague Convention from 1907, which referred to the observance of the laws and customs of warfare on land. During the First World War, biological weapons were not significantly used, and in the context of international legal regulations, there was no special prohibition of their use, but the general principles of the law of war were applied, and within that, the obligation to distinguish between combatants and civilians was of particular importance. No significant use of biological weapons was recorded between the two world wars either.

Nevertheless, under the pressure of public opinion, which was often reminded of the cases of the use of biological weapons in the First World War, in order to initiate an action by the world public and legal experts aimed at its forbidden, it was implemented a treaty ban, contained in the Geneva Protocol from 1925. This act prohibits the use of asphyxiants, poisonous and other gases, commonly called chemical weapons, as well as the use of bacteriological warfare methods. Namely, at that time, not much was known about other biological agents, so bacteria were specifically apostrophized. However, the Geneva Protocol did not prohibit the development, production and stockpiling of chemical and biological weapons, and its provisions were related only to the signatory states. Further efforts towards a complete ban were made without success within the League of Nations in the 1930s (Poli, 2022).

Due to the weakness of the Geneva Protocol, as well as a significant number of accusations about the use of biological weapons after the Second World War and the knowledge that an increasing number of countries were developing biological weapons programs, arose the need to conclude a new

international treaty on biological weapons. Negotiations that began in the 1960s resulted in the adoption of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxic Weapons and on Their Destruction (known as the Biological Weapons Convention) in 1972. (BTWC, https://www.un.org/disarmament/biological-weapons/).

Compliance with the letter of the Convention is based on three conceptual layers, one of which is legally binding, the second is politically binding, while the third is completely voluntary. The fourth level is for some reason not clearly defined, and it is actually verification, which remains one of the fundamental challenges of biological disarmament and non-proliferation. The main responsibility for compliance with the Convention rests with the resources of the signatory states themselves. A joint approach and strengthening of sincere and institutional cooperation at the regional and global level would represent a qualitatively new step in that direction, although today, in the current geopolitical arena, it seems realistically unattainable (Gerstein, 2013).

The Implementation Support Unit supports member states in their efforts to implement the provisions of the Biological Convention, as well as in the adoption and implementation of national legislation in this area. The World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (OIE) have an expert role in clarifying the events and situations that may relate to the possible use of biological agents, while the UN Security Council has a role of the final arbitrator in relation to allegations of potential violations of compliance with the letter of the Convention (Edwards et al, 2022).

This body was asked by Russia and the People's Republic of China in 2022 to investigate allegations about the US biological program carried out in this country and outside its borders, especially in the post-Soviet space and in Central Africa, as well as in other countries of the world. So far, there has been no adequate response to this request.

The regime of biological disarmament is in any case a complex task, which goes beyond the normative-legal framework and involves the engagement

of a large number of actors and structures, organizations and institutions, and especially the difficult-to-achieve control related to the misuse of science, ethical standards and the control of dual-use goods, as well as extremely important strengthening of people's awareness on an individual and collective level about the significance and possible consequences of this threat.

Basic principles of the Geneva Protocol and the Biological Convention

After the First World War, under the pressure of public opinion and the scientific public, the states accepted to regulate and sanction the use of chemical weapons, and with them, biological weapons. Negotiations were conducted and successfully concluded at the Conference on the Supervision of International Trade in Arms and Ammunition, which was held under the auspices of the League of Nations in Geneva in 1925, when, at the suggestion of France, the Protocol on the Prohibition of Asphyxiating, Poisonous and Similar Gases and Bacteriological Methods of Warfare was adopted. The protocol was signed by 38 countries at the time, and entered into force in 1928. To date, 146 countries have signed and ratified it, including all permanent members of the Security Council. The US ratified this Protocol only in 1975, after signing the Biological Convention (Alberque, 2022).

The Geneva Protocol is a short international treaty, consisting of a preamble, two substantive provisions and several final clauses. Since at that time it was not recognized the diversity of the world of microorganisms and since scientific knowledge was limited and scarce, even viruses were not distinguished from bacteria, the Protocol only talks about the prohibition of the use of bacteriological warfare agents. However, with later interpretations, it was clarified that the term "bacteriological" also includes other disease-causing agents (viruses, rickettsia, fungi), which makes it practically equivalent to the term "biological". In contrast to chemical weapons, the prohibition of the use of biological weapons is not declared as a rule in the preamble (Kelle, 1997).

In the operative part of the Protocol, states are prohibited from using biological weapons in war, which represents the first treaty prohibition of this type of weapon. In addition, signatories are also obliged to encourage other countries to accede to the Protocol, which has a more moral-political than legal character. In addition to its undoubted importance, the Geneva Protocol still has numerous shortcomings. First, it prohibited only the use of biological weapons, but not their development, production and transfer, nor did it require the destruction of existing stockpiles. Even the prohibition of its use was not absolute, but the Protocol prohibited the use of biological weapons against other signatories, but not against third countries. In addition, the signatories had no obligation to respect this prohibition in non-international armed conflicts. The unlimited possibility of placing reservations on its provisions can be considered a shortcoming of the Protocol, which was widely used by states, thus violating the spirit of the treaty. The most important and most common reservations related to: the freedom to use biological weapons against states that are not signatories, as well as the freedom to apply reprisals against the first to use biological weapons. In this connection, a number of Arab states have also expressed reservations regarding the application of the Protocol in the context of the conflict with Israel.

Shortly after World War II, the United Nations called for the elimination of all types of weapons "capable of mass destruction," both biological and chemical, as well as radiological and nuclear. Intense debates about their ban were conducted in the 1950s and 1960s, in the context of proposals for general disarmament, and especially in 1968 within the 18-nation Disarmament Committee. A year later, the United Nations published an exhaustive report on the problems of chemical and biological warfare, which was also discussed at the UN General Assembly (Goldblatt, 1986).

The UN report states that certain chemical and biological weapons cannot act in a limited manner and can cause serious and irreversible consequences for humans and the environment, as well as boomerang effects. In a special WHO Report on the Health Aspects and Consequences of the Use of Chemical and Biological Weapons from 1970, it is emphasized that the same poses a particular

danger to the civilian population and that its use carries a high degree of uncertainty (WHO, 1970). The socialist and non-aligned countries of the time strongly insisted on the simultaneous ban of chemical and biological weapons, while within the 18-nation Committee on Disarmament, the United Kingdom and several other Western countries imposed the position that biological weapons should be banned first and that this problem should be treated separately (Kelle, 1997). The greatest support for this position was provided by the USA with the announced unilateral renunciation of the biological program, as well as with the Government's decision of February 14, 1970 on the unilateral destruction of its stockpile of biological weapons, by which it officially renounced the production, storage and use of biological agents and toxins for war purposes, limiting the application of military biological programs to research and development in defensive purposes (Kelle, 2022).

Subsequent negotiations on the global ban of biological weapons led to the adoption of an international agreement, which was already positively declared by the UN General Assembly in December 1971. The Convention on the Prohibition of the Development, Production and Stockpiling of Biological (Bacteriological) Weapons and Toxins and Their Destruction was ready for signing on April 10, 1972, and officially entered into force on March 26, 1975, after the deposit of ratification by 22 signatory countries , including the governments of the Soviet Union, the United Kingdom, and the United States which were depositaries of signatures. So far, the Convention has been signed and ratified by 184 countries, while 4 countries have signed (Egypt, Syria, Somalia, Haiti), but have not yet ratified the Convention (Citaristi, 2022).

Today the BTWC is one of the three fundamental pillars of the international community's effort against WMD, along with the Nuclear Non-proliferation Treaty and the Chemical Weapons Convention (Davinić, 1975). Its key provisions are shown below, while the entire text of the Convention is attached to this work.

Article I	Undertaking never under any circumstances to develop, produce, stockpile, acquire or retain biological weapons.
Article II	Undertaking to destroy biological weapons or divert them to peaceful purposes.
Article III	Undertaking not to transfer, or in any way assist, encourage or induce anyone to manufacture or otherwise acquire biological weapons.
Article IV	The requirement to take any national measures necessary to prohibit and prevent the development, production, stockpiling, acquisition or retention of biological weapons within a State's territory, under its jurisdiction, or under its control.
Article V	Undertaking to consult bilaterally and multilaterally and cooperate in solving any problems which may arise in relation to the objective, or in the application, of the BTWC.
Article VI	Right to request the United Nations Security Council to investigate alleged breaches of the BTWC, and undertaking to cooperate in carrying out any investigation initiated by the Security Council.
Article VII	Undertaking to assist any State Party exposed to danger as a result of a violation of the BTWC.
Article X	Undertaking to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and information for peaceful purposes.
Article XI	Right to propose amendments to the Convention.
Article XII	Requirement to review (5 years after treaty comes into force) developments relevant to the purposes and operation on the convention- including scientific and technological developments
Article XIII	Right of a state to withdraw from the convention, in the event of extraordinary events which have 'jeopardised the supreme interests of its country'.
Article XIV	Processes of Signature, ratification and accession

Key provisions of the BTWC (Walker, 2016)

Compared to the other arms control agreements, the negotiations under the Biological Convention encountered more outstanding issues. One of them certainly refers to the unpredictability of the effects of biological weapons and the non-causing of immediate effects, so it was raised the question of its effectiveness during combat operations. The verification on possessing it was considered almost impossible, especially since the same microorganisms exist in nature. In contrast, chemical weapons are predictable, capable of producing immediate effects and, consequently, useful in combat. That is why most states that acceded to the Biological Convention did so under the condition that a complete ban on

biological weapons will be recognized as a step towards a complete ban on chemical weapons (Preamble and Article XI) (Edwards et al, 2022).

However, time has unequivocally shown that scientific and technological progress, modification of the conditions of production, storage and use of biological weapons, make these weapons more and more militarily attractive. Indeed, advances in biotechnology make it possible to "enhance" the properties of known biological agents, so that normally harmless organisms that do not cause disease can be modified to become highly dangerous and cause diseases for which there is no known or adequate medical treatment (Gerstein, 2013).).However, the Convention is flexible enough in its wording to cover scientific and technological developments, including biological agents and toxins that may result from the process of genetic engineering (Citaristi, 2022). Reports of the UN Special Commission that certain nations have or wish to acquire biological weapons , indicates that the danger of biological warfare remains a real threat and challenge. The experience of the COVID-19 pandemic with all its controversies and implications, as well as the subsequent tectonic geopolitical upheavals and the presented facts about biological programs that were carried out outside the borders of individual countries support these doubts.

Analysis of the Biological Convention and its weak points

In contrast to the Geneva Protocol, which does not contain any definition of biological weapons, the Convention clearly defines it in Article I, stating, as it was previously mentioned that under biological weapons are understood, together or separately: (a) microbiological or other biological agents or toxins, regardless of their origin or method of production, which by type and quantity are not intended for use for prophylactic, protective or other peaceful purposes (b) weapons, equipment or vectors, as well as other means of dissemination and application, intended for the use of those agents in hostile purposes or in armed conflict (Chevrier, 1995).

The Convention, however, did not precisely define the prohibited items or the targets to which the prohibitions apply (Beard, 2007). It is assumed that it relies on the definition of biological agents formulated by WHO in 1970 (WHO, 1970). However, today, in the era of scientific progress, especially in the area of synthetic biology, this definition is extremely relativized. Also, the wording of the Convention covers all natural or artificial toxins obtained by chemical synthesis, regardless of "their origin or method of production", which includes products of all living things (microbes - e.g. botulinum toxin, but also plants - e.g. ricin toxin and animals – e.g. tetrodotoxin) (Leach, 2021).

Since the signing of the Convention, until today, there have been no disputes between the parties regarding the definition of biological agents or toxins, but the wording of "weapons, equipment or means of delivery" has led to numerous controversies and open questions. Thus, when ratifying the Convention, Switzerland reserved the right to decide for itself which items fall within the mentioned formulation, while the US objected to this reservation, arguing that it would not be appropriate for states to enact such decisions unilaterally. According their view, prohibited articles are those whose design indicates that they cannot have a use other than that specified in the Convention, or that it can be adapted for the intended use. There are, however, few weapons, equipment or means of delivery that would unambiguously meet such criteria, while it is mainly a matter of commodities and means of dual use, so the Convention should be revised in this sense as well (Naik & Ramanathan, 2022).

According to the letter of the Biological Convention, the prohibition of the development, production, storage or acquisition and retention of biological agents and toxins is not absolute, but this wording applies only to types and quantities that cannot be justified by prophylactic or other peaceful goals (BTWC, https://www.un.org/disarmament/biological-weapons/). The retention, production, or acquisition of biological agents and toxins may thus continue, and testing may occur in laboratories and even in the field conditions. It can be seen that when determining biological weapons, the Convention uses the criterion of intended use, which is difficult to avoid, considering that microbiological and other

biological organisms are widely used in medical, scientific, prophylactic, protective, so-called. peaceful purposes (National Research Council, 2012).

Therefore, the Convention treats and contains only prohibitions regarding biological agents that are used for hostile purposes or in armed conflict, while their use for peaceful purposes is still allowed (Wissinger, 2015). However, the Convention does not clarify what exactly is considered to be purposes that are not prohibited, but only, for example, states that preventive and protective activities can be considered as such. During the negotiations, it was clarified that the term "prophylactic" includes medical activities, such as diagnostics, determination of therapy and immunization, while the term "protective" includes e.g. development of protective masks and suits, air and water filtration systems, detection and warning devices, and decontamination equipment, and must not be interpreted to permit the possession of biological agents for defense, retaliation, or deterrence (DaSilva, 1999).

The term "other peaceful purposes" remains unclear, and it can be assumed that it refers to scientific experiments, because there are no provisions in the Convention that limit biological research activities, which can be interpreted ambiguously. One of the reasons for this "omission" may be that it is difficult to distinguish the real purpose of biological research, i.e. whether they are civilian or military, and in that case, whether they are defensive or offensive weapons (Pearson, 2000). Also, in this area it is difficult to draw a clear line between research and development, because warfare agents can be developed in scientific research institutions. Once developed, these agents can be rapidly produced in significant quantities creating an objective risk that the provisions of the Convention may be circumvented (Beard, 2007).

In addition, the amount of biological agents that can be possessed in order to perform permitted activities has not been determined. There are no agreed standards or criteria for the quantities of agents or toxins that may be required by different States for the various purposes permitted by the Convention. The signatory parties are not obliged to declare the types and amount of agents or toxins they possess and their use, nor is this realistically possible, because

potential biological agents can also be found in the nature around us. A material accounting system that is useful in verifying certain arms control measures is not feasible in the case of biological agents or toxins. Secrecy surrounding the implementation of biological research activities, especially for the purpose of defensive preparations, which at certain stages cannot be clearly distinguished from offensive preparations, could generate suspicions concerning the violation of the Convention (Tucker, 2004; Raičević, 2010).

The Convention prescribes only the obligations of states with regard to biological weapons, but not the obligations related to facilities for their production and activities that are not prohibited, which significantly differs from the Convention on Chemical Weapons. The Convention on Biological Weapons is the first international treaty that, in addition to prohibiting the use of certain weapons, contains a wide range of other obligations. Experience has shown that if the states possess some weapons or they are able to acquire them, the mere prohibition of their use was not enough to thwart the use of those weapons in war (Wissinger, 2015). For this reason, efforts were made to establish other bans that should lead to the complete elimination of those weapons from military arsenals, which will make the ban on their use more effective. Following this logic, the Convention clearly imposes obligations related to the prohibition of the use, the prohibition of the development, production, storage and circulation of potential biological weapons, the obligation to destroy them, as well as the prohibition of aiding, abetting and guidance to the activities prohibited by the Convention (Naik & Ramanathan, 2022).

However, the prohibition of the use of biological weapons is not explicitly defined in the Convention. The first reason for this is the state's inability to use biological weapons if it complies with other obligations established in Articles I-III of the Convention (prohibition of development, production, stockpiling, acquisition and obligation to destroy). In addition, it is considered that the ban on the use of biological weapons has already been established by the Geneva Protocol from 1925, so there is no need to repeat the same ban in the Convention on Biological Weapons. According to the supporters of this understanding,

repeating the ban in the Convention would create the impression that the Geneva Protocol is invalidated, not only in terms of biological, but also chemical means of warfare. Due to the absence of an explicit prohibition of the use of biological weapons in the text of the Convention, its connection with the Geneva Protocol is emphasized, first in paragraph 2-4 of the preamble, and then in Article VIII of the Convention itself. In the preamble, the importance of the Geneva Protocol was highlighted and commitment to its principles and goals was confirmed, while calling on all countries to strictly comply with its provisions. Article VIII states that no provision of the Convention can be interpreted in such a way as to limit or diminish in any way the obligations undertaken by the States under the Geneva Protocol. This article aims to implicitly add the obligation to prohibit the use of biological weapons to the circle of other obligations provided by the Convention (Wissinger, 2015). The question arises as to why it is not defined explicitly, because such a regulation of the ban on the use of biological weapons can lead to a number of practical problems, since e.g. there is a possibility that a signatory of the Convention is not at the same time a signatory of the Geneva Protocol, so the question arises as to how we can oblige that state by banning the use of biological weapons. The problem is also represented by the reservations that a large number of countries have placed on the Geneva Protocol, which are incompatible with the obligation from the Convention that they will "never and under no circumstances" acquire biological weapons (Romanov, 1997).

Moreover, the Convention stipulates that nothing in its provisions shall be interpreted in the sense of limiting or diminishing the obligations undertaken by the States under the Geneva Protocol (Томилин, 1984). It is interesting that the Geneva Protocol does not sanction the use of prohibited weapons against states that violate the protocol, while its use is strictly prohibited by the Biological Convention (Article I). Precisely for this reason, when ratifying the Convention in 1984, the People's Republic of China declared that the absence of an explicit ban on the use of biological weapons is a deficiency that should be corrected. However, over the years, signatory states have withdrawn their reservations under the provisions of the Geneva Protocol, emphasizing that the prohibition of

possession implies the prohibition of the use of chemical and biological weapons (Huigang et al, 2022).

Despite this, a large number of states have still believed that an explicit prohibition of the use of biological weapons should be included in the Convention. In particular, Iran took the lead in the requesting of the amendment of Article I in terms of an explicit ban on the use of biological weapons, but this proposal, unfortunately, was not accepted, because the majority of the participants of the Fourth Review Conference that was held in 1996 believed that the ban on development, production, stockpiling and acquisition of biological weapons implies the prohibition of any use of such weapons, while other delegations expressed fear that changing of one article would open the door to many future amendments, thereby enabling the loss of the essence, strength and spirit of the Convention (Raičević, 2010).

It was pointed out, although it sounded unconvincing and unfounded, that the acceptance of the Iranian amendment would lead to the creation of different regimes that would be applied to the signatory states that accept and those that do not accept the amendment, thus creating the appearance that the other provisions of the Convention are not mandatory for these other countries, above all the ban on the use of biological weapons.

According to Article XI of the Convention, any amendment enters into force after it has been adopted by a majority of the signatory states, which did not happen in this case. Nevertheless, the Final Declaration of the Fourth Review Conference once again apostrophized and clearly stated that the Convention prohibits the use of biological weapons and that any application of microbes or other biological agents or toxins in any manner inconsistent with prophylactic, protective or other peaceful purposes, had to be treated as a violation of the Convention (Beard, 2007).

Obligations to prohibit the development, production, storage and transfer of biological weapons are prescribed in Article I, while the prohibition of the transfer of biological weapons is the subject of the Article III of the Convention. The signatory states have undertaken to never, under any circumstances, develop,

produce and trade in biological weapons, thereby preventing the increase of stocks present at the time the Convention enters into force. A separate article of the Convention prohibits the transfer of agents, toxins, weapons, equipment or means of delivery, defined earlier, to any state or group of states or international organizations, as well as sub-national groups or individuals. Aiding, encouraging or inciting the acquisition of prohibited weapons are also prohibited (Article III) (Romanov, 1997). These provisions are in direct conflict with the required engagement of the signatory parties in the "fullest possible" exchange of biological agents and toxins and equipment for the processing, use or production of such agents and toxins for peaceful purposes (Article X). Such materials, technologies and expertise are terminologically defined as dual-use goods and fall under other control regimes, such as the Australian Group, which, as already noted, was established in 1985. Namely, in order to reduce the risk of misuse of potential biological agents and means for their dissemination, the informal forum of industrialized countries considered certain restrictions on the trade and transfer of agents, materials and objects that could be used in possible chemical or biological warfare (Ashcheulova & Ambrosova, 2021). The direct impetus for the formation of the Australian Group was the use of chemical weapons in the Iran-Iraq war, while in 1990 its scope was expanded to biological weapons. Many countries consider this multilateral control regime unnecessary, because it is largely complementary to the Biological Convention, while other countries consider it discriminatory because its strict application mostly and hardly affects developing countries.

The ban on development also means that states are prevented from conducting scientific research with the aim of producing biological weapons, which practically prevents them from starting the production of biological weapons in the short term, even if they withdraw from the Convention or begin to violate its provisions. This ban also enables the production of more perfect types of biological weapons using scientific research. However, this clause does not refer to research aimed at the peaceful use of biological agents, which, as emphasized, are not precisely defined or specified.

The prohibition of production and storage aims to prevent the accumulation of stockpiles of biological weapons, which, together with the previously mentioned obligation to destroy, should enable the achievement of the final goal, the prevention of the use of biological weapons. The ban on trafficking means the ban on acquiring biological weapons from anyone, as well as their delivery to anyone. Signatory states are prevented from acquiring biological weapons, which ultimately prevents their use (Stern, 2002). This ban is primarily intended to prevent the acquisition of weapons from third countries that do not fall under the regime of the Convention. In addition to the acquisition ban, signatories are prohibited from transferring biological weapons to other actors, with or without compensation. This aims to destroy this type of weapon as completely as possible and reduce the total amount of biological weapons in the world. Without this ban, a large amount of biological weapons could probably be sold to interested third countries, which are not bound by the prohibitions of the Convention, thus increasing the potential biological threat even more (Citaristi, 2022).

The obligation to destroy biological weapons is prescribed by Article II, which requires states to destroy existing stocks of these weapons as soon as possible, and no later than nine months after the entry into force of the Convention. The Biological Convention obliges signatories to destroy potential biological weapons or to divert all agents, toxins, weapons, equipment and means of delivery to peaceful purposes (Article II). The Biological Convention was the first treaty to abolish an entire category of weapons. At that time, the US was the only country announcing that its stockpiles of biological and toxic agents and related munitions had been destroyed, except for small amounts for laboratory, defense and research purposes, and that facilities for the development of biological weapons had been turned into centers for medical research, while the United Kingdom and the USSR have officially declared that they have not possessed stockpiles of biological weapons.

Therefore, since the Convention entered into force on March 26, 1975, the deadline for the destruction of these weapons was December 26, 1975. However,

no specific deadline has been defined for states that sign the Convention more than 9 months after its entering into force, which would imply that they must destroy biological weapons before joining the Convention. This fact may seem unfair from a formal point of view, because before joining it, they have neither rights nor obligations arising from the Convention. States are left with complete freedom in terms of how to destroy biological weapons, and the Convention also allows the possibility of adapting existing biological weapons for peaceful use. Regardless of which method of destruction is chosen, the state must take all necessary measures to protect the population and the environment (Raičević, 2010).

Assisting a state, group of states, or international organization in the production or acquisition of biological weapons in any other way is strongly prohibited to the Signatory States. The Convention does not specify the types of assistance, but it certainly refers to the provision of economic support as well as technical and personnel assistance (Beard, 2007). Concerning to the economic assistance, it is very difficult to prove that the given funds were used precisely for the development of biological weapons programs, while it is much easier to do so when providing technical and personnel support to such programs. The Convention prohibits signatories from encouraging or inducing other states or international organizations to produce or acquire biological weapons in other manners. While in the previous case it was forbidden to provide specific aid, here we have in mind the prohibition of providing other forms of support that may sometimes contribute to the production and acquisition of biological weapons.

Each signatory party is obliged to take measures, in accordance with its constitutional powers, to prevent the activities prohibited by the Convention from taking place in its territory or in the area under its jurisdiction or control (Article IV). The term "measures" refers to legislative, administrative or regulatory measures, while the term "under its jurisdiction or control" (also used in Article II) extends the prohibitions to non-self-governing territories administered by States Parties, even to the territories under military occupation, and the wording anywhere can be also applied to transnational corporations operating in the

territories of countries that are not signatories to the Convention, if they are registered in signatory countries. This is particularly important because biological agents are becoming increasingly attractive to non-state actors, as was the case with the infamous Japanese sect Aum-Shinrikyo, whose leader worked intensively on the development of biological program, with a particular interest in the agents of anthrax and Ebola (Jonathan, 1995/2000).

Article VII obliging parties to provide or support assistance to a victim of BW attack *"if the Security Council decides that such Party has been exposed to a danger as a result of the Convention violation"*. There are multiple practical, legal and other complex operational challenges to the implementation of Article VII (Canada et al, 2017b). Proposals to address these include developing standardized procedures for requesting assistance, and establishing rapid response biomedical teams that could be delegated to a roster maintained by the BTWC and deployed in the event of a public health emergency (Russian Federation UK, 2018;). The Ebola and COVID-19 response showed the importance of international coordination and how much still needs to be done. Although it lacks a strong central agency, the BWC can continue to serve as a crucial instrument in collective defenses against deliberate diseases.

At the international level, the signatory parties have undertaken to consult each other and cooperate in solving the problems related to the implementation of the provisions of the Convention, which can also take place *"through appropriate international procedures within the framework of the United Nations and in accordance with its Charter"* (Article V). Since the Convention does not explain what is meant by "appropriate international procedures", it was later agreed, within the regular Review Conferences, that such procedures should include the right of any party to request an open "consultative meeting" at the expert level (Pearson, 1997).

The signatory countries have the right to report to the UN Security Council complaints regarding violations of the Convention, as well as to cooperate in the implementation of any investigation that the Security Council may initiate on the basis of the received complaint and have the right to be

informed of the results of such an investigation. Each complaint must contain "all possible evidence" that confirms its validity (Article VI). However, the question arises whether all states have the ability to collect such evidence or sincere allies to help them in this? There is therefore the possibility that, for political or other reasons (for example, reluctance to disclose the nature or source of evidence), certain powers will deliberately overlook wrongdoings committed by some states to the detriment of others. The UN Security Council can reject a request to consider a state that suspects a violation, on the grounds that it does not have reliable information and therefore does not possess sufficient evidence. Even if the Security Council agreed to discuss the accusation, there would always be the danger that the case would not be properly investigated. The Security Council, according to the UN Charter, has no right to check compliance with the arms control agreement; nor is it authorized to take action against violators of such agreements. Only when the Council determines that the situation created by the violation may lead to international conflicts, it recommends, according to Chapter VII of the UN Charter, the implementation of "appropriate procedure" towards the state(s) in question (Raičević, 2010).

Otherwise, the Convention signatory countries undertook to cooperate in the development and application of scientific knowledge and discoveries from the domain of biology for the purpose of disease prevention and for other peaceful purposes (Article X). However, since the Convention is essentially a disarmament agreement, it can hardly serve as an effective instrument for such cooperation, especially considering the fact that the gap between developed and underdeveloped countries in the sphere of biotechnology, nanotechnology, genetic engineering, microbiology and other branches of science is particularly large (Beard, 2007).

Shortly after the signing of the Convention, there were serious accusations between the two then leading superpowers, the USSR and the USA, regarding its violation. This primarily referred to the incident in Sverdlovsk in 1979, when an anthrax epidemic occurred in the area of the former plant for the production of biological weapons. Although the Soviets denied the accusations of the

production and storage of a large amount of anthrax weapons, which was not proven even by numerous joint scientific commissions, the USA used this event for pressure that resulted in the closure of this facility. The later president of the Russian Federation, Boris Yeltsin, decided in 1992. to enable international monitoring of this resource that was transferred to civilian purposes. Also, in 1981, the US government accused the Soviet Union of being involved in the production, transfer, and use of trichothecene mycotoxins in Laos, Kampuchea, and Afghanistan, thus violating the 1925 Geneva Protocol and the Biological Convention. Although these allegations were also categorically rejected by the USSR, the American accusations were based on chemical analyzes and reports of victims and eyewitnesses who stated that Soviet planes had been spraying the poisonous yellow material since the fall of 1978 (hence the name of the case). However, as the investigations continued, with the participation of analytical laboratories in different countries and careful examination of eyewitness reports, the reliability of the evidence was increasingly questioned, which is supported by the views of numerous scientific authorities in this field (Pearson, 1997).

In the latter period, there were many cases when many countries and peoples were accused of violating the Convention provisions, but this accusations, which was never proven, always came from the one side and were the reason for causing war conflicts and violating the sovereignty of countries, while those who accused the others, did not allow investigations of their biological programs, which were often carried out outside their borders as well (Citaristi, 2022).

That is why it is clear how important it is in the coming period to work on strengthening the international plan for a coordinated response of the Convention signatories, but especially the UN system, which must have the key function of coordination and helping members in building trust and the strong measures of multidisciplinary response to biological threats, as well as sanctioning violations of the BWC provisions based on a meritorious, truly expert determination of its violations, regardless of the actors they come from, which also implies restoring the trust in the entire UN system, including the often instrumentalized WHO, OIE, FAO, Interpol (UK, 2019b; Revill et al., 2021). It is also particularly

important to have clearly built system of prevention, preparation and response to biological threats at the national level, based on the experiences of previous epidemics or biological attacks. Institutional Strengthening of the Convention must be a subject of permanent discussion (BWC MX5, 2019) focusing on the "benefits and challenges". It is important that States Parties continue to support activities that highlight the BWC as a 'living' treaty, i.e. to encourage more States to join the BWC, to improve the cooperation as well as national implementation, preparedness and response (Feakes, 2017).

Verification measures, confidence building and strengthening as the biggest challenge

However, the biggest problem and lack of the Convention is certainly in the domain of verification measures and control of their implementation. Measures of national control (self-control) form the basis of the system of supervision over the implementation of the Convention, while international control is very scarce. The Second Review Conference in 1986 added introduced confidence-building measures (CBMs) anchored in article V, as a compromise following calls to strengthen the BWC with a legally binding verification regime (Sims & Littlewood, 2011).

The basic institutional deficit of the Convention lies in the fact that not a single international supervisory body has been established. For this reason, the system for ensuring compliance with the Biological Weapons Convention is based more on the trust than on the international supervision. As it was already said, the absence of a reliable system of international control over the observance of the assumed obligations is a major shortcoming of the Convention, which makes it more of a kind of "gentleman's agreement" than a binding international legal act.

In addition to all of the above, the Convention on Biological Weapons nevertheless provides some measures for implementation on the international level, as:

(a) the consultation and cooperation of member states, and

(b) submitting complaints to the UN Security Council.

Consultations and cooperation of member states are regulated by Article V of the Convention. The signatory states have an obligation to consult and cooperate in order to solve problems arising from inadequate implementation of the Convention. However, significant results can hardly be expected from this measure, especially when it comes to the signatories who are not in good political relationship, including the most powerful actors on the world stage, which is exactly what is relevant today. This is probably why the creators of the Convention envisioned the possibility of consultations and cooperation between states also within the framework of the UN. However, it is not said in detail within which authorities and by which procedures this cooperation will take place (Goldblat, 1986).

Article VI defines that each signatory state has the right to lodge a complaint with the Security Council if it suspects that other signatories are violating the provisions of the Convention. Such a solution was necessary considering that the Convention, as it has been emphasized several times, did not establish any international body that would deal with the supervision of its observance. When addressing the UN Security Council on this issue, the state must submit relevant evidence on the merits of the complaint. This condition greatly complicates the position of the complainant because it is very difficult for one signatory, which primarily refers to small states, to independently collect data on the alleged violation of the Convention (Ward, 2004). However, even if the state submits all the relevant evidence, it is not even considered, because sometimes it is not in the interest of the most powerful actors, especially with the right of veto.

In order to avoid the issue of politicization, it would be best if, before any discussion, the answer to all dilemmas was provided by an independent multidisciplinary international expert body that would constantly deal with this issue. Currently, the UN Security Council normatively has mandates to examine the facts and inform states about the results of the investigation, but it has no authority or obligation to definitively answer whether the provisions of the Convention have been violated and to take appropriate sanctions. The biggest

drawback of this procedure is the possibility of using a veto by a permanent member of the Security Council, which makes it impossible to consider the submitted appeal. Due to the aforementioned shortcomings, this procedure has not been applied in practice so far (Millet, 2010).

The Convention does not specify the measures to verify compliance with the obligation not to develop, produce, store, acquire or retain biological agents or toxins for "hostile purposes", because true intentions, according to the letter of this document, cannot be exactly verified (Chevrier, 1995). As mentioned above, parties are not required to declare biological agents or toxins used in non-prohibited activities, nor are they required to report all laboratories engaged in research and development of substances that could be used as means of warfare, which is a serious problem, because the progress of biotechnology has enabled the production of large quantities of potent biological/toxic substances, in a short period of time, by a small number of people and in facilities that are difficult to identify (National Research Council, 2012). Such substances can be stored in inconspicuous warehouses and possibly in the composition of missiles, bombs or spray systems for dissemination. Also, the signatory states of the Convention and those acceding to it are not obliged to report the possession or non-possession of prohibited weapons, nor are they required to prove that they have destroyed weapons or diverted them to peaceful purposes (Drobysz, 2020).

Consequently, especially in such situations, we cannot rely on the national technical means of verification, while currently there are no international means to perform such tasks (Dunworth et al, 2006). The Secretary General of the UN is authorized to launch an investigation based on reports from UN member states that draw attention to possible illegal activities in a country, violations of the Geneva Protocol or other international treaties or customs law, but this usually does not happen, because this issue is often politicized and it depends on supremacy and power (for example, the questions of Russia and the People's Republic of China regarding the biological activities of the USA outside its borders still remained without an adequate answer).

In the UN Security Council statement from 1992, it was taken a clear position that the proliferation of weapons of mass destruction, which includes biological weapons, would represent a "threat to international peace and security" and that appropriate measures must be taken to prevent it, including those covered by Chapter VII of the UN Charter. However, such a statement has no binding legal effect. Even if it were transformed into a formal decision, it would not necessarily enable the Security Council to act in all relevant cases. The right of veto held by permanent members can always be used to protect treaty violators, especially when they comes from the most powerful actors on the international stage. The proposal that the permanent members of the UN Security Council should give up their right of veto, at least with regard to resolutions concerning the investigation of complaints about the use of biological weapons, was not accepted, so it is considered that the representative body of the signatory states should deal with investigations of alleged violations of the Convention (Sims & Littlewood, 2011).

The fact that the fact-finding phase is not clearly separated from the legal/political consideration and sentencing phase represents a serious shortcoming of the Biological Convention. A state suspected of breaching its obligations also have not an international impartial mechanism to turn to in order to clear itself of that suspicion, especially if it is a field of possible manipulation, as it has been proven in the past when often unsubstantiated allegations of WMD possession were even used as the formal reasons for making reckless accusations or even taking of military action with impunity, even without the approval of the UN Security Council (Drobysz, 2020).

On the other hand, in the case of an established violation of the provisions of the Biological Convention, the parties would have to provide or support assistance, in accordance with the UN Charter, to the party that requested it, if the Security Council determined that it was really exposed to danger due to the violation of the Convention (Article VII). That help should be of a medical and humanitarian nature and it would be provided in accordance with the capabilities

of the Convention member states, therefore it would be of a non-obligatory nature and it could even be refused (Goldblatt, 1997).

The Convention stipulates that the Review Conference will be held five years after its adoption (Article XII), while the signatory parties later agreed to meet every five years, in order to monitor scientific and technological progress and prevent the misuse of biological weapons (Raičević, 2010).

Recognizing the weaknesses of the prescribed measures for implementation long ago, the signatory states tried to overcome them at the mentioned Review Conferences, by adopting certain sets of measures for confidence building, such as: exchange of data on research centers and laboratories, exchange of information on the occurrence of infectious diseases and the epidemiological situation on certain territories (Enemark, 2010), encouraging the international scientific and expert contacts/conferences, publication of national biological defense programs, strengthening of biological safety and biological security standards, publication of legislation related to the implementation of the Convention, publication of earlier activities in terms of defensive (offensive) biological programs, informing about vaccine production factories and other scientific and technological capacities that can be misused for the potential development of biological weapons (BWC MX5, 2019). However, all the measures do not have a legally binding character, so they can also be subject of abuse, as well as mechanism for collecting data and controlling the resources of small countries, while the most powerful actors on the world stage have no obligations (VERTIC, 2016). All this has been noticed and recognized a long time ago, but for some reason nothing concrete has yet been undertaken, although many efforts have been made in this direction (Naik & Ramanathan, 2022).

In this regard, already at the Third Review Conference, it was made decision about creation of a group of government experts with the task to determine and examine possible verification measures, which was called VEREX (verification experts). This group was supposed to study the possibility of introducing new verification measures and confidence-building measures, related

to the exchange of information on scientific capacities and research, taking into account the increasing progress in science and technology. This set of confidence-building measures has been extended to the exchange of information on former offensive biological programs, but also to programs and opportunities for vaccine production and relevant legislation in the field of biological weapons control (Sims&Sims, 2001). The VEREX report was discussed in 1994, during a special conference of Convention member states. One of the results of this meeting was the creation of a new negotiating body, the Ad Hoc expert scientific and technical group, whose task was to propose concrete measures, which would become legally binding, because the previous ones, based on a voluntary approach, did not yield results. The Ad Hoc Group produced a number of working versions of the Protocol on the Convention Strengthening, but these negotiations broke down in July 2001, when the US declared that it would not accept the proposed text as the basis for a legally binding agreement (AHG, 2001).

Although the leading world countries have made significant progress in the preparation, signing and implementation of other multilateral disarmament control regimes, including strategic offensive weapons, parity in nuclear weapons and have established serious cooperation in these areas, which are even more complex and demanding, the stagnation in the domain of control of biological weapons coincided with the demands to pay less attention to the activities of governments, especially the most powerful countries, and to pay more attention to the activities of individuals, scientists, economic and commercial entities and other non-governmental actors in civil society, which could be significant in preventing the proliferation of biological weapons and protecting of human health and the environment (Citaristi, 2022).

Review conferences held in 2001/2002. and in 2006 did not manage to overcome the deadlock. The Implementation Support Unit was established in 2006, with the task of coordinating and providing the necessary information to the contracting states. Although the Ad Hoc Group still exists formally, it is difficult to expect it to continue working on the draft protocol that was ceased in 2001, but it is constantly advocated to move from the zero point, with reference to the

dynamic changes taking place in the world in recent years considering the increasing importance of weapons of mass destruction in modern conflicts, acts of terrorism, as well as the consequences of epidemics and pandemics, climate change, migration, and the possible unfathomable consequences of the uncontrolled development of science and technology, especially genetic engineering and biotechnology in this sphere (VERTIC, 2016).

Thus, in contrast to the praise it deserves for the wide range of prohibitions regarding biological weapons, significant criticism can be directed at the Convention due to the absence of an international monitoring mechanism for compliance with the obligations undertaken (Drobysz, 2020). As it was mentioned several times, it was not established any international body that would control how states fulfill their contractual obligations. In the absence of an international mechanism, measures of national control (self-control) represent the only guarantee that there will be no violation of the Convention. This is an explanation why the system for ensuring compliance with the Biological Weapons Convention is more based on trust than on international oversight. Aware of the weaknesses of the supervisory mechanism, the signatory states launched an initiative to strengthen it (Zanders&Smithson, 2011). However, although there has been significant progress in certain periods, these efforts have so far not borne fruit. It can even be said that in the last ten years there have been significant disagreements among the contracting parties regarding the procedures and methods for strengthening of the verification measures (Littlewood, 2010).

So, despite the fact that a lot of time has passed since the adoption of the BWC, as well as constant and ad hoc negotiations conducted in this domain, there are still no reliable instruments for checking compliance, nor elaborate verification mechanisms, in order to deter potential violators. Until they are established, the Convention parties are expected to implement the confidence-building measures (CBM) agreed at the Review Conferences (BWC MX5, 2019). This decision means that participation in the CBMs is a politically binding requirement for all BWC States Parties. In order to maximize their transparency, increasing number of States Parties are now also making their CBM submissions

publicly available and thus available for analysis by civil society as it was done at the 2016 Review Conference by 30 States Parties. These countries also published information about previous biodefence programs developed in 18 countries (Lentzos, 2019a).

Conflicting views on the verifiability of the BWC remain a fundamental challenge for biological disarmament and non-proliferation. Strengthening the BWC regime requires satisfying a range of political and diplomatic constituencies within the treaty's membership requiring action across all its substantive articles, including article X. Measures to enhance peaceful cooperation and capacity-building among States Parties must also be integral to the way forward (Canada et al, 2017a, Littlewood, 2018).

As already noted, most important among confidence-building measures are those that increase the transparency of activities related to biological agents and toxins, including the exchange of information on facilities and research programs relevant to the Convention, about vaccine production, as well as significant and uncommon disease outbreaks. However, in order to enable the very difficult differentiation between prohibited and contractually permitted activities, the objects of the prohibitions will have to be more clearly defined, and the criteria necessary for assessing compliance will have to be unambiguously established (Chevrier, 1995). Moreover, in addition to short-term visits to reported places, on-site inspections of non-reported places will have to be accepted without reservation by all parties. It is clear that sensitive commercial proprietary and national security information, not directly related to the Convention, must be reliably protected (Tucker, 2004; Littlewood, 2018). A special organization will be needed to oversee the implementation of the signatories' obligations. It is considered that this is the right moment for this kind of activity and the formation of this kind of organization.

This year it will be celebrated the fiftieth anniversary of the Biological Weapons Convention and in the same time, it will be hold the regular five-year Review conference. The international community should restart the negotiations on the Verification protocol of the Biological Weapons Convention, which has

been stalled for more than 20 years. The issues of essential strengthening of the mechanisms of the Convention must be raised, including the formation of an expert body with executive powers, a respectable international scientific committee, financed by UN parties, to whom it will be directly and solely responsible (Данельян& Гуляева, 2022).

UN Security Council Resolution 1540: contribution to the fight against bio-weapons

Globalization has caused the intensification of security threats in the world, as well as a change in their character. Security threats become more asymmetric and more and more originated from non-state actors, and the fight against them requires new and different methods and greater international cooperation (Podbregar & Ivanuša, 2011). Contemporary threats to security do not recognize national borders, which is clearly seen in the example of the strengthening of international terrorism and organized crime, as well as the potential use of weapons of mass destruction.

On April 28, 2004, the UN Security Council, in accordance with Chapter VII of the UN Charter, unanimously adopted the Resolution 1540, confirming once again that the spread of nuclear, chemical and biological weapons and the means for their dissemination is a threat to international peace and security. It is the first UN Security Council resolution that explicitly mentions joint efforts to counter threats to international peace and security arising from the proliferation of weapons of mass destruction and their means of delivery (Asada, 2008).

By the United Nations Security Council Resolution 1540, all states are called upon, in accordance with their national legislation and international law, to take joint measures to prevent the spread of WMD, including biological, means and materials for their delivery, as well as to respect relevant international legal instruments (Goldsmith & Posner, 2005).

In accordance with the Resolution, all states are obliged, in particular, to refrain from providing any form of support to non-state actors that attempt to develop, acquire, produce, possess, transport, transfer or use nuclear, chemical or

biological weapons and the means of their delivery /dissemination. Committee 1540 was formed in order to implement the Resolution (Khripunov, 2014).

Resolution 1540 obliges all states to enact laws to prevent the spread of nuclear, chemical and biological weapons and their means of dissemination and provides for the establishment of appropriate national controls over potentially dangerous materials to prevent illicit trade (Poley, 2022). It also calls for greater international cooperation in the context of such efforts.

The resolution emphasizes the importance of supporting multilateral agreements aimed at eliminating or preventing the proliferation of weapons of mass destruction and reaffirms the importance of all signatory states to fully implement these agreements, as well as to establish the effective measures of adequate internal controls in order to prevent the proliferation of weapons of mass destruction and the means for their transfer, including the control over the appropriate materials related to recording of suspicious materials, security and safety measures, border, police and custom control over export and transfer of dual-use commodities.

It is clearly stated that Resolution 1540 implementation does not contradict to the obligations of member states related to the Treaty on the Non-Proliferation of Nuclear Weapons, the Convention on Chemical Weapons and the Convention on Biological and Toxin Weapons (Revill & Dando, 2009).

On April 27, 2006, the UN Security Council extended the mandate of the 1540 Committee for a period of two years by Resolution 1673, which reaffirmed the goals of Resolution 1540, stressing that the Security Council is interested in intensifying the work of the Committee in order to fully implement this resolution. On April 25, 2008, the Security Council adopted resolution 1810, which extended the mandate of the 1540 Committee for a period of the next three years, with further expert support and the request for strengthening its role in the provision of technical assistance, including active proposals for effectively implementation of the UN Resolution 1540. As a part of the comprehensive review, the 1540 Committee decided to hold an open meeting with a wide range

of participants from UN member states and relevant international organizations, which was held in 2009.

On April 20, 2011, the Security Council adopted Resolution 1977, thus confirming again that the proliferation of nuclear, chemical and biological weapons and the means for their dissemination presents a serious threat to international peace and security, and extended the mandate of the 1540 Committee for 10 years, until 2021. This clearly shows that the Security Council recognized that the full implementation of resolution 1540 by all states is a long-term challenge that will require constant efforts at the national, regional and international levels. Resolution 1977 also foreseed two comprehensive reviews, one after five years and one before the renewal of the mandate.

In addition, the 1540 Committee, in accordance with resolution 1977, should continue to strengthen its role in facilitating the provision of technical assistance and intensify cooperation with relevant international organizations. The Committee must also continue to improve its efforts on the ground and ensure the transparency of its activities. On June 29, 2012, the Security Council adopted resolution 2055, which expanded the expert team of the 1540 Committee to nine (9) members (Stan&Perkins, 2013).

On December 15, 2016,was adopted the Resolution 2325, which, among other things, calls on all states to intensify their efforts to achieve the full implementation of Resolution 1540. The Security Council on April 22, 2021 also adopted the resolution 2572, which extended the mandate of Committee 1540 until February 28, 2022. As the planned comprehensive review was postponed to due to the COVID-19 pandemic, the Security Council unanimously on 25 February, 2022, adopted the resolution 2622, again extending the mandate of the 1540 Committee until November 30, 2022. The Council also decided that the Committee, continuing to work in accordance with its mandate, will continue and complete a comprehensive review of the implementation of Resolution 1540 and the report to the Security Council about the review (Citaristi, 2022).

The obligations under UN SC Resolution 1540 are multidimensional and their implementation on the national level requires the participation of all state

holder adn authorities responsible for security, non-proliferation, as well as prevention of terrorist threats and accidents with weapons of mass destruction and its components, i.e. fission materials, chemical and bioagents (Revill & Dando, 2009).

The development of the National Action Plan for the implementation of UN Security Council Resolution 1540 (hereinafter: NAP 1540) should enable and facilitate review of the goals of UN Security Council Resolution 1540, in the national framework, determining the measures and responsibilities needed for its comprehensive and full implementation, coordination between all relevant state authorities, as well as encouraging effective cooperation and systematic monitoring of the implementation of measures (Goldblatt, 2021).

The search for political solutions to conflict situations and efforts aimed at stabilizing and normalizing the situation in conflict areas are also of vital importance to prevent the spread of WMD (Colf, 2016). The danger that weapons of mass destruction come into the possession of structures over which the state has no control, especially terrorist groups and individuals, represents a special security threat. In this regard, it is necessary to constantly undertake measures and activities aimed at identifying potential risks. In addition to the normative-legal framework that prevents the development, production, transfer and use of weapons of mass destruction, it is important to establish coordination mechanisms that will additionally strengthen the measures of supervision and control (Millet, 2006).

It is necessary to raise the level of awareness about the danger of proliferation of weapons of mass destruction through the organization of citizen educations, the cooperation of the economy, the academic community, and the civil and non-governmental sector. Bearing in mind that the consequences of the use of weapons of mass destruction, including biological ones, can be catastrophic, it is necessary to work on the adequate preparation of all available national capacities for their mitigation (Lentzos, 2019b).

In addition to taking preventive measures, it is important to precisely define measures for timely mitigation of consequences in the event of a disaster caused by weapons of mass destruction (Dunworth et al, 2006).

The goal of the 1540 Committee and the independent experts who comprise it is to assist governments undertaking efforts to prevent the proliferation of weapons of mass destruction and to enable the Security Council to best tailor its future work on this vital issue. Resolution 1540 of the UN Security Council is certainly an important step that enables the world to be saved from weapons of mass destruction, which depends on whether each country does its part. However, the events in the world geopolitical arena and the strategic security situation in the modern world and the time in which we live assure us that this is absolutely not enough, but that only the formation of a permanent international independent body for monitoring and preventing the potential use of biological weapons will eventually lead to a reduction of this threat which is very well recognized by the leading countries of the world (Colf, 2016).

In this sense, the progress of science also represent a dual-use commodity, because on the one hand it contributes to the improvement of detection measures, identification of biological agents and measures of diagnosis, prophylaxis and treatment of the diseases caused by them, while on the other hand it can contribute to the creation of even more lethal and specific weapons (Børsen Hansen, 2006).

Can scientific progress be directed in the right direction, can and should science be controlled and treated like a commodity? Is it a normative, intelligence-security or ethical issue?

4.2. **Misuse of Science in the Context of Biological Weapons Development**

As it was previously mentioned, non-compliance or violation of the most important international treaty-BWC carries the heaviest legal and ethical conviction - *a crime against humanity*. But immediately after its adoption it was clear that the existence of this Convention did not prevent continuous

development and work on BW research programmes in various states. No one of many known facilities were not destroyed in the US or the USSR, all human and material resources were kept, and research including genetic engineering continued into "defensive purposes" as it was previously described. Many accidents from that period have testified about such activities and the work with potential BW (e.g. the mentioned Sverdlovsk anthrax release, the death of researcher Nikolai Ustinov after laboratory infection with Marburg virus etc.) The bacterial cultures from US ATCC basis were legally sold until 1989 to many countries which were later accused of possessing the same by the US itself such as Iraq (e.g. the strains of *Brucella spp.* and *Bacillus spp*.). In the same time happened many terrrorist actions in different countries using B agents that were already mentioned (the "*Order of the Rising Sun*" cult in 1972 obtained typhus to contaminate water sources of the US West Coast; Georgi Markov was killed in 1978 with ricin capsule placed in an umbrella; one Marxist group in West Germany planned the use of botulotoxin; the extreme group "Dark Harvest Commandos" used anthrax in 1981 for contamination of the luggage of some British politicians, the "Rajneesh" Cult spread *S. typhimurium* bacteria in Oregon in 1984, the Aum Shinrikyo cult performed at least 9 ineffective terroristic attacks with B agents such as *Clostridium botulinum* and *B. anthracis*, while the anthrax attack in 2001 in USA opened questions concerning awareness, biosafety, biosecurity and other implications of possible bioterrorist actions) (Beauchamp& Childress, 2001).

Terrorism is today global evil and using of the WMD is real possibility as an old game under new rules and with new modern technologies. Biological weapons and agents cause the greatest concern because by their potential use can be achieved even strategic level effects. Rapid development in the field of life sciences, especially the knowledge in the understanding of gene organization and function as well as the progress in biotechnology and nanotechnology provide new opportunities for biodefence as well as new opportunities for further development of BWs. Sometimes it might be extremely difficult, to decide at once which discoveries are desirable and which are potentially dangerous, especially in

the area of fundamental sciences-physics (e.g. chain reaction and its use for nuclear bombs), chemistry, biology… (Ehni, *2008*).

The understanding of the complex biochemical pathways that underlie life processes has the potential to enable a class of new biological agents engineered to attack distinct biochemical pathways and elicit specific effects, so the same science that may cure even the worst diseases could be used to create the world's most frightening weapons (Central Intelligence Agency Directorate of Intelligence, 2003).

The danger is all the greater because the genomes of most known microorganisms have been sequenced today and the sequences are easily available on the Internet or in scientific and professional publications. These findings opened not only a Pandora's box of possible manipulations, but also numerous ethical and security dilemmas about whether the results of such research should be published, who decides on this and who can have access to them (Gutmann & Wagner, 2010).

In any case, the manipulation of the genome segments of the pathogenic microorganisms became a reality in the last decades of the 20th century that made possible establishing of the microbial resistance to antibiotics and other environmental factors, increasing of their virulence, making its identification more difficult due to the changing of their antigenic composition, which would even render existing vaccines ineffective (Minoque et al, 2019).

These manipulations were relatively simple for scientific teams and their results were often used in offensive biological weapons development programs in many countries. In this, of course, the two leading superpowers of the time, the USA and the USSR, took the lead. As a result of such experiments it was enabled that the causative agent of the plague, the bacterium *Y.pestis*, became resistant to 16 antibiotics, or it was obtained the anthrax strain resistant to penicillin.

By the inserting of new segments of DNA into bacterial genomes, for example, *E.coli* became a successful factory for the production of botulinum toxin or the lethal anthrax factor. Soviet scientists altered the immunogenic properties of anthrax, rendering existing detection methods and vaccines ineffective. They

also created a new vaccine against that modified strain. The US researchers also modified the causative agent of anthrax.

New molecular engineering technologies have made possible to modify existing microorganisms thus becoming even more deadly and opened the way for the development of new "hybrid-chimeras" that were created by crossing of various existing microorganisms and exchanging of their segments. In the USA, similar experiments were conducted with mousepox and cowpox viruses (which can also be human pathogens), so the lethality of this hybrid was increased by optimizing the insert. Such findings opened various possibilities of potential manipulation with the variola virus in order to increase its virulence through possible sequence changes. In Great Britain, during trials of hepatitis C vaccine production, the hepatitis C virus crossed with the Dengue virus, resulting in the creation of a "Dengatitis virus" that was "more lethal than HIV". In the laboratories of the former USSR, the Ebola and smallpox viruses were crossed, which resulted in the creation of a dangerous hybrid - the Ebolapox virus (Ristanović, 2015a).

Genome sequencing of *Y.pestis, V.major, B.anthracis* enabled further deciphering of sequences responsible for their pathogenicity, invasiveness and virulence factors, which could open the possibility for further manipulation of these genes and conversion of non-pathogenic microorganisms into highly virulent ones.

Directed molecular evolution (molecular shuffling) implies the separation of the genetic material of microorganisms into smaller fragments that are spontaneously reassembled in a changed order, thus accelerating the creation of new strains by 20 to 100 times. On that manner was constructed a strain of *E.coli* that was even 32,000 times more resistant to some antibiotics compared to naturally acquired resistance (Ristanović 2009, 2018).

Nowadays, there is even talk about the use of genetic weapons that would be specific to a certain race, nation, population, even family, and would be based on the characteristics of genetic polymorphism, in order to act on target populations using their genetic specificities, e.g. by secretly inserting of a latent

(stealth) virus into certain parts of the genome, haplogroups and markers, that can be activated at the appropriate moment by some impulses (Ristanović, 2015a). That virus would be harmless to the rest of the population. For this reason, attempts to collect DNA material from certain ethnic groups and populations have been intensively discussed for several years. Recently, the US Air Force Training Command (AETS) announced an offer to purchase Russian DNA and biological tissues. The potential supplier had to send samples and provide information about the health status of the donor. It is the most terrible weapon for mass destruction of the target population with perfect selection, without material and environmental destruction and damages. Genetic profiling of individuals and populations is today an important tool for intelligence services, and in connection with this, rapidly arises the need for protection of both individuals and nations genetic material (Walsh, 2018). In this context, some scientific authorities are asking why during the past two years, such massive genetic tests were conducted all over the world for the presence of the corona virus, if it was already known that the virus was present in circulation. While it took more than ten years for the atomic bomb to go from a scientific concept to reality, the development of genetic weapons seems to be going much faster (Atlas & Dando, 2006).

The possible abuse of bioregulatory substances is also discussed. These are proteins identical or related to some molecules that exist in the body, they act as enzymes or coenzymes and regulate our biochemical cycles and physiological processes (consciousness, sleep, fertility, regulation of temperature, blood pressure, reaction to pain), so that their application or changing of their concentration could significantly impair the physiological state of a living organism. Due to their chemical instability, they are not suitable for contaminating of larger spaces like viruses or bacteria, but they can therefore be used against individuals (Ristanović, 2009).

Insects can also be used in biological warfare and bioterrorist acts. Using genetic engineering in some experiments are obtained the insects that could produce highly toxic substances that cause a wide range of consequences - from mild, non-threatening, to very serious, such as sterility, the causing of fatal

diseases in the target population, etc. They can be used to spread vaccines, like "flying needles". Genetically modified plants can also be used as a way to produce and apply vaccines, as well as enzymes and growth hormones (Ristanović, 2009). Such possibilities, unfortunately, represent the reality of the times in which we live. The production of "contraceptive plants" that produce antibodies to human sperm is also a real possibility, as well as the design of the "contraceptive vaccine" that, if used to control the population of other species, could cause incalculable ecological consequences. From all the above, it is clear what consequences the abuse of genetic engineering and biotechnology can produce and how important is to prevent it (Danzig, 2012).

The great achievements of molecular biology, genetics and technology have undoubtedly revolutionized the agriculture, industrial processes as well as the medicine. The same results also pose an unpredictable risk due to the possibility to create the bioweapons of next generation (Committee on Research Standards and Practices to Prevent the Destructive Application of Biotechnology, 2004) and can be considered as *"dual use research of special concern"*.

This term predominantly refers to the research that provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, agricultural crops and other plants, animals, environment, materials, or security (Berger et al, 2012). Biological research could be more exposed to the risks of misuse and affected by dual-use dilemma in comparison to the other scientific fields, because it seems possible that in the future, technological advances will enable using synthetic techniques for bio-weapons produce by the smaller groups without significant scientific expertise and serious state control (Faden & Karron, 2012).

All mentioned above is one of the reasons why the bioethics today present very important branch, placing the enormous amount of attention on (i) the protection of human and animal research subjects, (ii) ethical, legal and social implications of genetics predominantly focused on potential environmental hazards of recombinant DNA research, genetic determinism, genetic testing,

discrimination by employers and insurance companies, selective reproduction, genetic enhancement, cloning, stem cell research, DNA fingerprinting and the patenting of DNA sequences (Selgelid,2009).

Unfortunately, with a few exceptions, bioethicists usually had relatively pure knowledge about security in general or the dual-use dilemma in this field. In particular, bioethicists neglect questions about whether it is ethical to produce and/or disseminate scientific knowledge (Selgelid, 2010). So, it is necessary to establish an international consensus in bioethical approaches in order to protect humankind and prevent possible misuse of biotechnology in the area of BW development (Ristanović, 2018).

The threat of synthetic biology misuse will be even greater than that posed by nuclear technology misuse because nuclear technology is likely to remain bulky and expensive, in comparison to the quite portable technologies required to produce bioweapons. The openness in the life sciences could be also a potential problem, because the much of the basic knowledge relevant to synthetic and so called dark biology is already publicly available in contrast to very often classified and confidential advances in nuclear technology (Douglas & Savulescu, 2010).

Some Experiments of concern and their potential consequences

As confirmation of all previously mentioned, we could here present some of the earlier published results of scientific research in this area. The Journal of Virology in 2001 published an article of the Australian scientists who attempted to create a genetically engineered sterility treatment for mice, which periodically breed out of control in some parts of the country. The scientists spliced a single foreign gene for interleukin-4 (IL-4), the cytokine that regulate immune system reactions, into a genome of a mild mousepox virus. The result was a creation of a highly virulent mousepox strain that could kill both naturally resistant as well as the mice vaccinated against the mousepox (Jackson et al., 2001). A disturbing implication of the experiment is that adding of the IL-4 gene segment might

similarly increase the virulence of smallpox, as one of the biggest biothreats (or some other poxvirus that infects humans) (Miller& Selgelid, 2007). The same or some other technique might also be applied for the control of human fertility in the future that could also present a great problem.

Poliovirus is member of *Picornavirus* family with a single-stranded RNA molecule of approximately 7500 nucleotides. The three immunologically distinct serotypes are human pathogens. In this study, scientists chemically synthesized a Polio genome without template, by stringing together strands of DNA which sequence was purchased over the Internet. The process was time consuming, but straight-forward.The cDNA was converted into RNA and put into a protein mixture. The experiment conducted under a program of developing the biowarfare countermeasures, can be considered as the first creation of life in a test tube. It resulted in the creation of a virus that paralyzed and killed mice developing a neurological disease both chemically and histologically indistinguishable from naturally occurring poliomyelitis (Cello et al, 2002). The researchers said they "made the virus in order to send a warning that terrorists might be able to make biological weapons without obtaining a natural virus". Similar techniques might enable production of even more dangerous biological agents, such as previously mentioned smallpox or Ebola (Selgelid, 2009). So, these experiments are real dual-use issue of concern.

In the following example, researchers used published information on DNA sequences to engineer a SPICE protein (*smallpox inhibitor of complement enzymes*) produced by the smallpox virus. The study revealed the ways in which, and the extent to which, this protein could defeat the human immune system potentially increasing the virulence of the vaccinia virus (Rosengard et al, 2002).

The another case of concern was already mentioned reconstruction of the Spanish flu H1N1 influenza virus that caused the great pandemic in 1918/19, using preserved archived autopsy materials and a lung tissue of an influenza victim who had been buried in the permafrost of Alaska for RNA sequence generation and subsequent viral reconstruction as well as further recombination with other viral strains using reverse genetics. (Kaiser, 2005). The experiments

showed that the 1918 virus gene sequences were closely related to any other H1N1 influenza strains. These examinations on the reconstructed virus may facilitate development of drugs and vaccines against possible future influenza pandemics, but such obtained virus at the same time could be potentially misused by malevolent actors and used for the artificial preparation and modification of new viral strains (Selgelid, 2009).

The researchers from The Craig Venter Institute in Maryland, USA in 2010 announced the creation of the first living and replicating bacterium with a synthetic genome that slightly differs from wild-type *Mycoplasma mycoides* (Gibson et al. 2010). It was a "proof of principle" for the synthesis of the new bacteria which have not naturally existed before and the early-stage example of "creating life". Other synthetic biologists have been permanently seeking for even more fundamental re-design of life and even developed two new bases which can be incorporated into DNA alongside the existing four bases, and then replicated by naturally existing enzymes (Douglas & Savulescu, 2010).

It is undeniable that synthetic biology has many potential benefits in the fields of environment and energy production, health care and industry. But it also opens a number of issues associated with its potential misuse as well as many ethical, social and legal concerns about its impact on society, public health and the environment in addition to the ownership, innovation, regulation and oversight questions (Chen et al. 2015).

The revolutionary method of aerosolized medicines delivering using large porous carrier particles increased the amount of inhaler-delivered drug that put it deep into the lungs. (Edwards et al, 1997). But its dual-use implications became clear after 5 people died from inhalation anthrax in 2001 as the existing of opportunity to engineer an inhaled drug delivery system and increase terrorist ability to bypass natural defenses (Edwards, 2002).

In the past, the only option for developing biological weapons was to select strains of certain features, including environmental stability, lethality, ability to be aerosolized, as well as the antibiotic resistance. The recombinant DNA technology and increased understanding of biological systems enables

modification of desired characteristics and their engineering into pathogens as well as application of medical technologies in order to increase the efficiency of agents delivering.

The technology which raises the most concern today is the genetic construction and reconstruction of pathogenic microorganisms by biotechnological methods as well as the so known gene surgery procedure so called CRISPR-Cas9, developed by American researchers in 2012, as a high-precision gene-editing tool which opened up incredible possibilities in genetic engineering (Graham&Root,2015).

It is clear that the rapid progress in molecular biology and possible genetic manipulation will continue, so it is necessary to consider the existing biosecurity control measures and expand them to keep pace with technology development. In spite of regulations, it is also clear that the dual-use dilemma is inherently ethical in nature (Faden & Karron, 2012).

Although a huge number of journal articles and books on ethics and genetics had been already written they include little, if any, discussion of the potential role of genetics and life-science development in making of weapons for the potential killing of innocents. It is also an ethical dilemma for the researchers as well as a dilemma for governments concerned with the security of their citizens, as well as their health and environment (Miller & Selgelid, 2007).

There is a basic conflict between the researchers′ freedom and the obligation to prevent greater harm which is really difficult to solve. As individuals, we are only responsible for something we can control, so the point is to what degree the scientists alone and the scientific community can be able to control such effects (Ehni, 2008).

Could scientists be responsible for the way the knowledge they produce will be used further? Should we promote scientific research that can be, for instance, used to develop WMD including BWs? It is mainly the question for Governments/editors who have the power or authority to assist or restrict dissemination of researchers' work. On the other hand, scientists have two kinds of specific professional responsibilities: internal, regarding to the respect of the

best standards of practice approved by scientific community including responsibility towards the animals and people involved in medical research and toward society (Kuhlau et al, 2008). So, the ethics should be an integral part of the education and training in order to encourage young scientists to respect and adhere to the basic ethical principles and responsibilities of science (Cetto, 2000).

The principle of good scientific behavior is reflected in Merton's ethos of science, suggesting that good scientific practice includes sharing of scientific results with others, because the science is "universal". The scientists should not only be involved in the production of new knowledge; they must be also committed to be critical towards their colleagues and their results ("organized skepticism" as the basis of science). The scientific communities must also take care of funding and must be also warned not to let their projects be financed by structures with special interests (Hansen, 2006).

Recent advances in biotechnology raise many different and often controversial issues. Discoveries of new ways of improving or enhancing life raise public hopes and expectations, but they also increase the public concerns and, often, fears. Proponents of synthetic biology cite its potential to reduce our reliance on fossil fuels and transform medical care and human health, among other possible benefits. Critics express concerns about "playing God," threatening to biodiversity and the natural history of species, as well as the longstanding concepts of nature (Lentzos, 2020b). With these opportunities and achievements comes an obligation to consider carefully both the promise and potential perils that they could realize (Presidential Commission for the Study of Bioethical Issues, 2010).

Research misconduct is defined as any behavior by a researcher, intentional or not, that fails to scrupulously respect high scientific and ethical standards including fabrication of data, plagiarism, problematic data presentation or analysis, failure to obtain ethical approvals or to obtain the subject's informed consent, inappropriate claims of authorship, duplicate publication, and undisclosed conflict of interest. Misconducts, whether done intentionally or through ignorance, have the same consequence (Jain, 2010).

Principles in Biomedical and Biodefence Research: Ethics or Control?

The important morality principle imposes us to consider the consequences of our actions for other people as well as the environment and it also obliges scientists as well as all human being. Biomedical research is the subject of ethical standards that promote and ensure respect for people and protect their life, health and rights - dignity, integrity, right to self-determination, privacy, and confidentiality of personal information of research subjects. Scientists must consider the ethical, legal and regulatory norms for examinations involving human subjects in their own countries as well as applicable international norms and standards (World Medical Association. 2013).

The ethical principles of animal research laid out the concept of the "Three R's": *replacement* of conscious living animals with non-sentient animals or materials, *reduction* of the number of animals used in the experimental procedures, and *refinement* of the techniques used in order to decrease the amount of animal pain and distress. This principle inspired the movement for alternatives for using of animals in biomedical research and testing. These concepts have been adopted by a number of scientists and many animal advocacy organizations and it has already become the content of the laws of some countries (Bishop & Nolen, 2001).

The principles of autonomy, non-maleficence and justice were argued to be essential mid-level principles mediating between high-level moral theory and low-level common morality, and they are very popular in writings about medical ethics (Beauchamp & Childress, 2001). But there is one bigger problem: how can policy help shape the scientific enterprise in such a way as to give due weight both to its role in producing knowledge and to the reduction of potential dual use risks (Buchanan & Kelley, *2013).*

So, the optimization is crucial term, because it emphasizes that the task is not to maximize the realization of any one value (such as protection against bioterrorism), or to achieve an acceptable trade-off between just two values (such

as ‘open science’ and biosecurity), but rather to achieve an overall outcome that gives due weight to all relevant values (Buchanan & Kelley, *2013).*

A well established ethical principle within science research is the principle to prevent harm. An important distinction can be made between *intentional and unintentional harm.* The connection between intentional (and direct) participation in developing of biological weapons and harm is evident, but it is less obvious in the case of legitimate and peaceful research subjected to unintended misuse and its potential to cause harm. So it is particularly important to be always aware of all potential and possible reflections of your work and its potential risks and consequences. It also includes considering your role as a scientist in any kind of crisis, emergency or war situation and your relation to the all existing regulations (Kuhlau et al, 2008).

Concerning the dual use dilemmas, scientists should consider whether the harm connected with their research is foreseeable, proportionally greater than the benefits and whether possible misuse is capable of being controlled, restricted and prevented by institutions or it can lead to the development of weapons of mass destruction (Lentzos, 2020a). The question here is how far they are responsible for the foreseen effects and for their prevention. The editors of scientific journal also have great ethical responsibility. On some occasion an editor may consider that the potential harm outweighs the potential societal benefits of publication. The journals and scientific societies can play an important role in encouraging investigators to communicate their results in ways that maximize public benefits and minimize risks of misuse (Selgedid, 2007). Voluntary self-regulations about dual use dilemmas are unacceptable. Career advancement generally requires a strong publication record and scientist's interest thus may be in conflict with national security because scientists and journal editors are not usually security experts. On the other hand, security experts are likely to be biased in favor of security over scientific values (Selgedid, 2007). There is also reason to doubt on the expertise of the governmental decision-makers that is commonly insufficient to judge the scientific importance of the studies they might want to censor (Selgelid, 2009). Thus, neither the scientific community nor the

government authorities has the competences to make final assessment regarding the results of research and dissemination of information involving discoveries which have potential implications with weapons of mass destruction. The balance requires the evaluations handled by a group embodying experts in science and in (bio) security as well (Selgedid, 2007).

Researches undertaken in the field of prevention or mitigation of biological threats can be used to cause harm by non-state terrorists or aggressive state actors or even by one's own government. This is another possible negative outcome of research, concerning governments and authorities (Buchanan, Kelley, 2013). Anyway there is a panoply of diverse ethical considerations that relate to biodefence including clinical testing of potential therapies and vaccines, preventing unauthorized individuals from entering research laboratories that is also an important biosecurity issue, dual use dilemmas in publishing of the obtained results, developing of harmful technologies, allocation of educational resources etc. (Loike & Fischbach, 2013). The adoption of a code of ethics for research could prevent the life sciences from becoming the dead sciences. Thus, the ethics can be an important and valuable weapon to counter bioterrorism and to prevent misuse of potential BWs (National Research Council, 2011).

In the case of eventual bioterrorist attack or biological warfare ethical principles and priorities could be changed. In such circumstances could appear many questions with possible ethical consequences concerning allocation of resources and personnel-health care providers and their personal approach in relation to health risks or fear for their own safety, the problem of triage and treating patients either on first come, first treat basis or triage in order to save the greatest number of lives in disaster (Ristanović, 2018). To address these issues to the maximum benefit of potential victims, patients or exposed persons, we must first develop collective broad-based consensus. Critical decisions like these should not be made on the case-by-case basis. So, the physicians should never be placed in a position of deciding to deny treatment to patients without the guidance of a policy or the adequate protocol (Pesik et al, 2001).

It is clear that many ethical questions have been already opened in the field of biodefence, bioresearch public health, medical and environmental ethics as well as governmental and international relational ethics and even the ethics of the war-conducting (Gutmann & Wagner, 2010). International dialogue and consensus as well as ethical guidelines must be a part of strategy for the humankind survival in the world where bioterrorism as well as BWs and WMD in general present a real, serious and global threat and dangerous enemies who do not recognize any boundaries.

Biological research in the arena of current geopolitical battles

The pandemic of COVID-19 has shown everyone that such a complex health crisis, apart from medical, also has numerous geopolitical, security, socio-psychological and economic implications. The question of the origin of the virus was imposed from the very beginning and ranged from the geopolitical sparks between the USA and the People's Republic of China, all the way to social networks and the infodemic that has been a constant companion of this event since its beginning. The race in vaccine production as well as the competition over which vaccine is accepted in various part of the world, has shown that human health and lives, which everyone swears by, for the leading players in the international geopolitical arena, are not so important and do not represent a common goal. When it seemed that the virus had infected a large part of the world's population and that its pathogenic potential began to weaken, we faced with new challenges (Ristanović & Zejak, 2020).

The Ministry of Defense of the Russian Federation announced at the end of March 2022 that a network of about 30 laboratories, all of them of the third level of biological safety, was built on the territory of Ukraine in the former period. The laboratory staff, often with diplomatic immunity, applied knowledge of microbiology, molecular genetics and synthetic biology with the aim of improving the properties of pathogenic microorganisms, including the causative agents of anthrax, plague, cholera, hemorrhagic fevers or designing of new and

even more dangerous ones. According to these claims, their work was particularly intensified after the 2014 political coup. In the extensive documentation released by the Russian Ministry of Defense are given the exact locations of these laboratories, the lists of pathogens at their disposal, evidence of funding of their research projects by the US Department of Defense and the other countries, as well as detailed descriptions of these projects, which were also aimed to collect material from infected people, potential reservoirs and vectors and strains of infectious agents. According the statements, the examinations were related to the modification of these microbes, strengthening their potential to evade the host's immune response as well as the possible production of ethnically specific biological weapons whose target would be the Slavic population (https://eng.mil.ru/en/special_operation/news/more.htm?id=12414584@egNews).

In the report was presented the data on the transfer of microbes, their potential reservoirs and vectors, but also blood samples of the local population taken for testing for COVID-19 or other infectious agents to laboratories in the USA and other research centers around the world, as well as the experiments with infected wild migratory birds that would be used as potential carriers of Newcastle virus, bird flu and many other microbes, and the results of styding of their migratory routes. The data on the incidence of human and animal diseases in the geographical area in which these laboratories are located and its surroundings, including the other European countries, are also precisely stated.

In addition, the documents published by Russian officials indicate the participation of Germany in military-biological programs carried out in Ukraine, primarily related to the study of the potential for the spread of deadly diseases, such as Crimean-Congo hemorrhagic fever, in the territory of Eastern Europe. According to these statements, the Ukrainian side undertook to deliver blood samples of the Slavic ethnic corps from different parts of the country to the German institutes as part of the cooperation. The project was financed by the German Ministry of Foreign Affairs and the Bundeswehr. Experiments with bats conducted since 2017 at the Lugar Laboratory in Georgia, as well as at laboratories in Ukraine, Azerbaijan, Turkey, Armenia, Jordan and China, are

presented as part of a US-funded project that is planned to be completed by October 1, 2022. According to the Russian officials, 10.2 million dollars were allocated for this project alone. It was also presented the evidence of the urgent and organized destruction of pathogen stocks, which was carried out by the order of the Ministry of Health of Ukraine, immediately after the beginning of the Russian military operation, on February 24, so that the Russian forces would not come into possession of evidence of the work in laboratories directed to the improving of the properties of microorganisms by methods of synthetic biology, which would clearly indicate a violation of the Biological Convention (BTWC) (https://eng.mil.ru/en/special_operation/news/more.htm?id=12417369@egNews).

Professionals and scientists have been pointing out the danger posed by biological weapons for years and explaining why they can be considered a strategic threat. It was also pointed out to interesting locations where the biological laboratories of the highest level of biosafety were established, at the beginning of the new millennium, especially in the post-Soviet area. Officially, the laboratories were under the control of the competent ministries of health, and they were built on the remains of former Soviet facilities, with the aim of strengthening biological safety and protection. The necessity of the immediate closure of these laboratories was emphasized in the previous years by some Ukrainian medical experts and politicians as well as colleagues from several countries around the world, advocating the formation of an international movement for the immediate liquidation of "death factories" and the elimination of the growing threats from the misuse of biological agents, expressing concern for safety, the lives and health of the local population through petitions that were sent to the President of Ukraine several times during the past year, and which can be found on his official website (https://petition.president.gov.ua/petition/126550).

The signatories of these initiatives state that after September 11, 2001, the US spent 100 billion dollars on the development of offensive biological weapons and that within the framework of the Pentagon program, several hundred laboratories and facilities of the third level of biosafety were established around

the world. The laboratories are not responsible to the governments of the countries in which they are located. These scientists based their claim on the facts that in Kharkov, where one of these laboratories was located, in January 2016, 20 Ukrainian soldiers died of swine flu, and another 200 were hospitalized. By March of the same year, swine flu had claimed 364 lives in Ukraine. An epidemic of measles broke out in 2017, while in 2019, the disease "with symptoms similar to the plague" was recorded. The increase in the incidence of African swine fever was recorded in the previous period in the entire post-Soviet area, but also in the area of Southeastern Europe, including Moldova, Romania, and Serbia. The use of agents against plants and animals, leading to economic losses, the undermining of the agricultural sector and the loss of livestock, which can ultimately provoke a major famine and food crisis (https://petition.president.gov.ua/petition/126550).

The USA strongly denied the allegations of the Ministry of Defense of the Russian Federation, classifying them in the domain of information warfare (https://foreignpolicy.com/2022/03/02/ukraine-biolabs-conspiracy-theory-qanon/).

However, the real question is what would be the reasons for the possible construction of such capacities. One of them is certainly to locate potentially dangerous facilities and researches as far as possible from their own territory, in order to formally avoid responsibility for violating the Biological Convention. At the same time these facilities would be located closer to areas that are of special strategic interest to a country or its allies. Thanks to these capacities, it is possible to monitor the biological (epidemiological-epizootological) situation in the areas intended for the possible deployment of military contingents, as well as to collect strains of dangerous pathogens circulating in a certain territory and conduct scientific-research work on the study of potential bio-agents specific for a given region. Examining the impact of dangerous pathogens on humans, taking into account racial and ethnic factors, may indicate interest in the development of selective biological weapons directed to the specific ethnic groups. Such military-biological activity would undoubtedly represent a violation of the Convention on the Prohibition of the Development, Production and Stockpiling of Biological and Toxic Weapons. It would represent a direct threat to biological security in a wider

geographical area, in the above-mentioned case, not only on the territory of Ukraine and Russia, but also to the countries of the Central an Eastern Europe.

By the way, the general public could already sense the dimensions of the problem in 2017, when they were pointed out by the former Minister of National Security of Georgia, who went to Moscow and presented a document on the work of a biological laboratory in the immediate vicinity of Tbilisi, which was even named after to the famous American senator, Richard Lugar, who together with his colleague Samuel Nan, initiated the so-called Program of Joint Cooperation aimed at reducing the threats (Wright, 2006). While the story of the Georgian laboratory and the experiments carried out there with the causative agents of anthrax and the vectors of numerous other infectious diseases (mosquitoes, ticks, sand flies) and the increase in the incidence of illness among the local population captured the public in Russia and the post-Soviet space, the rest of the planet then dealt with the Skripal case, the alleged poisoning that somehow at the same time captured media attention, especially in the western part of the planet.

On the world map it is clearly noticeable a group of laboratories in the immediate vicinity of the People's Republic of China, as well as those built in the fertile belt of Central Africa, a continent that is home to many viruses, including the aforementioned Ebola, which, along with the Marburg virus that is now active in Ghana, belongs to group of the largest and most dangerous viruses. Africa is also the homeland of jewels, diamonds, numerous minerals and ores for which the most powerful actors on the world stage are fighting (Zhao et al, 2022).

By the way, it is known that many epidemics of infectious diseases broke out in the previous period on the border perimeter of China and Russia, as well as in Africa, including the death of 7,000 birds in the Crimea due to the appearance of a rapidly mutating bird flu, the recent epidemic of bubonic plague on the border among Russia and China and Mongolia (Yakovchits et al, 2021), as well as an unexplored cattle disease in Kazakhstan, not far from the Chinese border. After all, according to Professor Francis Boyle, the author of the American law against bioterrorism, more than 13,000 scientists in 400 laboratories in the US and abroad are engaged in the creation of new strains of microorganisms, potentially resistant

to vaccines. According to this professor, the Ebola epidemics in Sierra Leone, Guinea and Liberia in 2014, in which thousands of people died, were the result of vaccine testing in a laboratory in Kenema, Sierra Leone (Boyle, 2020).

The events in Kazakhstan, at the beginning of January this year, were briefly in the focus of the media attention of the public, who were informed about the failed coup attempt, while the creators of information flows somehow missed the news about the biological laboratory in Alma Ata, where were found the strains of brucellosis, Hantan virus that causes hemorrhagic fever with renal syndrome, which is also endemic in our area (Yeh et al, 2021), Congo-Crimean hemorrhagic fever, as well as coronavirus strains, allegedly collected and isolated from different animal species.

The People's Republic of China expressed genuine concern and expressed the need for this problem to be seriously considered at the international level, because, according to their knowledge, there are as many as 336 such laboratories around the world. Chinese diplomats also asked very specific questions, including why the US does not allow independent international monitoring of its biolaboratories in the USA and outside of it, and why they unilaterally prevented the implementation of the provisions of the Biological Convention, whose signature depositories they were? China is resolute and demands a comprehensive response, demanding Washington to disclose information about the goals and content of the military biological program, taking the initiative to organize international inspections of US military biological facilities (https://english.news.cn/20220309/f9f1679037754d28b365b0901c077fd0/c.html).

The conservative American media demand the immediate closure of all US biolaboratories abroad, recalling that after September 11, 2001, the US spent 100 billion dollars on the development of offensive biological weapons and that hundreds of laboratories and facilities of the third biosafety level were created around the world as part of the Pentagon's program, which are not responsible to the governments of the countries in which they work.

The American officials firstly expressed their concern that the examined samples, results and documents do not fall into the hands of Russian forces, and

then, as it was mentioned, they strongly denied all this and classified it as an information and propaganda war, emphasizing that the laboratories were engaged in routine medical-epidemiological tests. The World Health Organization (WHO) also announced, asking the competent health authorities of Ukraine to destroy very dangerous pathogenic microbes and their products - toxins, which are found in these laboratories, in order to prevent their possible leak. As it turned out, this organization is extremely well acquainted with the research being carried out. (https://www.reuters.com/world/europe/exclusive-who-says-it-advised-ukraine-destroy-pathogens-health-labs-prevent-2022-03-11/). Some of the dangerous biomaterials were actually destroyed, some of them were taken to the west of Ukraine and to neighboring countries. But this, of course, does not guarantee their safety and does not guarantee that the pathogens will not fall into the hands of extreme nationalists and terrorists who have shown interest in them for a long time.

The diplomatic war moved to the East River, so on March 11, 2022, at the request of Russia, an emergency session of the UN Security Council dedicated to the "military biological activities" of the USA on the territory of Ukraine was held. The positions of the most powerful still remained the same, while many countries claimed that they knew nothing about the alleged Ukrainian biological program (https://press.un.org/en/2022/sc14827.doc.htm).

This problem is still very current. For the sake of truth, it is worth recalling that a similar session of the UN Security Council was held many years earlier, admittedly at the request of the USA. Accusations of possession of biological weapons, which were never proven, then served as a reason for the invasion of a sovereign country.

Microbes can leak out of Ukrainian laboratories, come into the possession of mercenaries, infect local populations fleeing war-torn areas. Microorganisms also move with migrations... The experience of COVID-19 teaches us that the uncontrolled spread of bio-agents cannot be stopped.

4.3. Control of the transfer of strategic commodities

The control of international trade in weapons, military equipment and dual-use commodities, as well as the international and national regulations that result from it, have their historical continuity. These facts are generally understandable to the social community in the segment of conventional weapons, as well as all the restriction measures that exist in this domain. However, since the Gulf War of 1991, international attention has also paid to the manners how to prevent the proliferation of weapons of mass destruction, as well as the dual-use goods and technologies that could be used in the WMD production (Anderson, 1991).

WMD, as it has been pointed out several times, traditionally implies the chemical, biological and nuclear weapons, as well as missile and other systems for launching them. Controlled dual-use commodities are considered to be goods and technologies that, in addition to civil, may have a military purpose, as well as those goods and technologies that can in any way help in the production of nuclear weapons or other nuclear explosive devices, chemical and/or biological weapons or means or devices for their dissemination (Ristanović & Jevtić, 2010). Many of these commodities are actually commercial items, as well as the corresponding technologies, which are often found in foreign trade. But, according to certain technical characteristics, properties, methods of use and final purpose, these items can be misused in the production of WMD and systems for their application and dissemination. This term also includes computer programs, softwares and technologies, as well as goods that can in any way help in the production of weapons that pose a threat to world peace (Committee on Research Standards and Practices to Prevent the Destructive Application of Biotechnology, 2004). Particularly sensitive and at the same time very delicate control in this area involves also the transfer of technical data, in the both physical and/or electronic form, including the oral transfer of the so-called invisible technology. The real question arises is how truly possible these measure are, and can the establishment of such control have other effects and even be a tool of intelligence actions?

Biological agents are realistically present all around us, they do not radiate and cannot be detected by special scanner border regimes. The control of knowledge transfer sometimes enters the domain of basic human rights and freedom of movement, while the each control regime, along with numerous advantages, also carries the possibility of abuse. The entire chain of production, testing and dissemination of potential biological weapons is characterized by the use of dual-purpose goods, so the control of their transfer is certainly an important part of the overall control of the non-proliferation of biological weapons (Ashcheulova & Ambrosova, 2021).

The control of dual-use goods trade is relatively new in both international and national legislation (Poli, 2022). It is in accordance with the aforementioned United Nations Security Council Resolution 1540 on the WMD non-proliferation. In the EU, competence for the application of export control regimes of dual-use commodities and appropriate technologies is part of common trade policies. According to the regulation, member states have the discretionary right to decide on the full application of this legal act, requests for permits issuing, as well as the processing of potential violation of legal provisions derived from the relevant ratified international agreements, such as Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (CWC) and the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxicological Weapons and on Their Destruction (BTWC). Such regulation also obliges the states to declare to competent international organizations about the performed export and import of the controlled nuclear and fissile materials, as well as chemicals, microorganisms, toxins and other materials, equipment and related technologies, as dual-use items, in order to prevent the spread of WMD. Export control regimes are multilateral cooperation agreements and one more trial to improve the effectiveness of national export control measures. The most important actual export control agreements are: *Wassenaar Arrangement* - WA, *Nuclear Suppliers Group* - NSG, *Zanger Committee, Australia Group* - AG and *The Missile Technology Control*

Regime – MTCR dealing with the control of various type of WMD (Committee on Research Standards and Practices to Prevent the Destructive Application of Biotechnology, 2004).

A liberal foreign trade policy prevails in the modern world, including the principle of free movement of goods, technologies and services. In relation to this "umbrella" principle, laws in the field of foreign trade and control of dual-use goods translated into a legal obligation, represent some kind of "*lex specialis*" and the basic mechanism of limiting and monitoring of the trade of goods and technologies, which are considered to be controlled. It actually represents a set of preventive measures aimed to ensure that the export of dual-use goods, technologies and services, in this regard, does not contribute to illegal or undesirable activities of companies and entrepreneurs in other countries related to the proliferation of WMD. It is also a normative basis and mechanism for the implementation of the dual-use commodities export control policy, verification of end users, confirmation of receipt of goods, as well as a list of controlled products and precisely defined exemptions (Ristanović & Jevtić, 2010).

In a practical sense, the dual-use export and import control system includes: issuance of individual permissions according to a special procedure, adoption of the National Control List of dual-use goods - NCL, control and verification of the End User Certificate and other documents, issuance of certificates for the dual-use commodities import and potential re-export after control and verification of the relevant documentation, issuance of a decision in the administrative procedure, control of the violation of legal provisions etc.

Biological dual-use items could be used either for peaceful purposes (medicine, prevention, protection) or for non-peaceful purposes, such as development and production of biological weapons. The pathogens, toxins and genetic elements with such features are called dual-use biological agents while the equipment with such character is called dual-use biological equipment (i.e. fermenters, biosafety cabins, centrifuges etc.) (Faden & Karron, 2012). Dual-Use Biological Agents and Related Equipment and Technologies Export Control List usually includes items according to their dual-use specialty in biological area, as

well as their estimated risk grade for non-peaceful purpose. These items will be discussed in details in the following paragraphs.

The term pathogen means the natural or genetically-modified pathogenic microorganism which can cause death, disease or other harms to human beings, animals or plants (National Research Council, 2011). The pathogens controlled in the List include isolated living pathogens as well as any kind of biological materials (e.g. cell, tissue, serum and animal), or non-biological materials contaminated with these pathogens. The list usually includes the following **human or zoonotic pathogens** such as: bacteria (*Clostridium perfringens, Clostridium tetani, Enterohaemorrhagic Escherichia coli, serotype O157 and other verotoxin producing serotypes, Legionella pneumophila, Bacillus anthracis, Brucella abortus, Brucella melitensis, Brucella suis, Chlamydia psittaci, Clostridium botulinum, Francisella tularensis, Burkholderia mallei, Burkholderia pseudomallei, Salmonella typhi, Shigella dysenteriae, Vibrio cholerae, Yersinia pestis, Coxiella burnetii, Bartonella quintana, Rickettsia prowazeki, Rickettsia rickettsii etc.*), viruses (*Louping ill virus, Omsk haemorrhagic fever virus, Powassan virus, Rocio virus, St. Louis encephalitis virus, Chikungunya, Congo-Crimean haemorrhagic fever virus, Dengue fever, Eastern equine encephalitis virus, Ebola virus, Hantaan, Junin, Lassa fever, Lymphocytic choriomeningitis virus, Machupo virus, Marburg, Monkey pox virus, Rift Valley fever, Tick-borne encephalitis virus (TBEV), Variola, Venezuelan equine encephalitis, Yellow fever virus, Japanese encephalitis virus etc.*); **animal pathogens** (bacteria-*Mycoplasma mycoides*, viruses - *African swine fever, Avian influenza virus, Bluetongue virus, Foot and Mouth Disease, Herpes virus, Lyssa virus, Newcastle virus, Peste des petits ruminants virus, Porcine enterovirus type 9 (syn. swine vesicular disease virus), Rinderpest virus, Vesicular stomatitis virus*); **plant pathogens** (bacteria-*Xanthomonas oryzae, Xanthomonas citri*, viruses-*Banana bunchy top virus*, fungi-*Deuterophoma tracheiphila, Monilia rorei, Helminthosporium oryzae, Puccinia graminis, Puccinia striiformis, Pyricularia grisea/Pyricularia oryzae etc*). All pathogens, natural or genetically modified, that could be used as BW, with the exception of those prepared for vaccines are under the export control. Vaccines

are the medical products which stimulates a protective immunological response in humans or animals in order to prevent disease that has entered into clinical trial, production or trade as approved by the competent department (Ristanović&Jevtić, 2010).

Toxins are the biological active materials and their subunits, originated from any microorganism, animal or plant, whatever their method of production, either natural or modified, which can cause death, disease or other harms to human beings, animals, and plants. Some of the controlled toxins are the following: botulinum toxin, *Clostridium perfringens* toxins, conotoxin, Shiga toxin, *Staphylococcus aureus* toxins, tetrodotoxin, verotoxin, microcystin (syn. cyanginosin), aflatoxins, abrin, cholera toxin, T-2 toxin, HT-2 toxin, modeccin toxin, viscumin etc. Controlled toxins do not include immunotoxins and human medical products.

Genetic elements controlled in the List include both genetically-modified or unmodified chromosomes, genomes, plasmids, transposons, and vectors, i.e. all materials that contain nucleic acid sequences associated with the pathogenicity of any of the controlled microorganisms or nucleic acid sequences coding for any of the previously mentioned toxins or their sub-units (National Research Council, 2011).

Dual-Use Controlled Biological Equipment considers i.e. the equipment for the micro-encapsulation of live microorganisms and toxins in the range of 1-10 micron particle size, phase separators, fermenters of less than 100 litres capacity capable of cultivation of pathogenic microorganisms, viruses or for toxin production, conventional or turbulent air-flow and self-contained fan-HEPA filter units that may be used for BSL3 or BSL4 containment facilities as well as facilities that meet the criteria for BSL3 or BSL4 containment as specified in the WHO Laboratory Biosafety Manual (2nd edition, Geneva, 1993), chemostats and continuous and cross (tangential) - flow filtration systems, centrifugal separators capable of continuous separation of pathogenic microorganisms, without the propagation of aerosols, and having a flow rate greater than 100 litres per hour, components of stainless steel or titanium capable of in-situ steam sterilization,

steam sterilisable freeze-drying equipment, protective full or half suits or hoods dependent upon a tethered external air supply and operating under positive pressure; Class 3 biological safety cabinets or isolators with similar performance standards (e.g. flexible isolators, dry boxes, anaerobic chambers, glove boxes, or laminar flow hoods, as well as aerosol inhalation chambers designed for aerosol challenge testing with pathogenic microorganisms, or toxins).

Biosafety Level 3 (BSL3) means the containment level that can meet the specified criteria with respect to microbiology facilities in the maintenance of negative air pressure to the environment, access control and the rendering safe of exhaust air, contaminated material and waste, including effluents by HEPA filtration, microorganism operating regulation and personnel precaution. Biosafety Level 4 (BSL4) means the containment level specified in the WHO Laboratory Biosafety Manual with respect to microbiology facilities containing the airlock or pass-through autoclave system, biosafety cabinet class III or positive-pressure ventilated suits and a special controlled air system. All that used to reach a higher biosafety containment (Danelyan & Gulyaeva, 2022).

Related controlled technologies include technical data and assistance, except knowledge in the public domain, or basic scientific research controlled in the List. Under control is also all related technology for production of biological agents or development of the previously mentioned dual-use biological equipment. Technology also implies specific information necessary for the development, production or use of a product and possible BW. The technical data include blueprints, plans, diagrams, tables, engineering designs, manuals and instructions written or recorded on media or devices such as disks, tapes, read-only memories. The technical assistance includes offering instruction, skills, training, knowledge, consulting services, as well as transfer of technical data. Once the dual-use biological equipment controlled in the List is approved to export, the export of basic technologies related to the equipment (installation, operation, maintenance, repair) to the same end-user is also authorized (Faden & Karron, 2012).

If the exported or imported dual-use items belong to the security or defense forces of the home or other country a permission is not required in cases when their transfer is done in order to fulfill the obligations originated from international agreements and membership in international organizations, as well as participation in multinational operations, in international trainings/exercises, or providing of humanitarian aid in emergency cases (Tamada & Achilleas, 2017).

Otherwise, along with the application for the issuance of the permit, the applicant is obliged to submit the original End User Certificate obtained by the official body of the country of the end user, or another appropriate certificate or document issued by the competent body of the country of final destination, which is not older than six months (Nayan et al., 2019).

There are numerous programs dealing with the capacity building and compliance with international standards and multilateral trade regimes in order to prevent the spread of WMD and destabilizing accumulation and irresponsible transfers of conventional weapons as well as the building of effective national systems of strategic trade and border control in countries that possess, produce or deliver strategic goods, or through which this commodities are transferred. The subject of such programs are also the specific regulation of trade in goods on the checklists, in order to prevent from falling them into the hands of someone who would use the items unscrupulously, as well as to detect and prevent the illegal transfers across borders. This is a real support to international efforts in establishing a global architecture for the prevention of WMD proliferation and fulfilling obligations under important international initiatives, including UN Security Council Resolution 1540 (Ristanović & Jevtić, 2010; Nayan et al, 2019).

In order to improve dual-use and arms trade controls it is necessary to raise the quality of available information on national, multilateral and international export control systems and standards including producing publications, developing tools, conducting awareness-raising activities, and carrying out capacity-building efforts aimed at strengthening national export control systems as well as broader cooperation among countries around the world (Faden & Karron, 2012).

4.4. MEDical INTelligence: a powerful tool for protection against biothreats

The health status of a certain nation or population is not only a medical issue, but also a factor that in the short and long term affects the social, economic and political trends in society, the state and a certain geographical area, which ultimately makes it unstable and vulnerable to different, and rather all biological threats. In this sense the health of the nation or population as the ultimate value category is placed in the context of security. Because of that, the intelligence-security segment is a key link in the prevention of potential biological threats (Petro, 2004).

MEDINT (MEDical INTelligence) is a form of intelligence and security work that, in a comprehensive sense, essentially deals with the aforementioned areas, using various methods of collecting information that, through the classic intelligence cycle, become the subject of professional processing with the aim of providing a quality and timely intelligence product that will enable making better decisions. MEDINT can be defined as "the application of medical and biological knowledge in the interest of national defense" (Jarcho, 1991) or as: "a systematic process of collecting and analyzing data related to health hazards, threats, risks and medical capacities in certain areas" (La Gioia, 2015).

The US Ministry of Defense defines MEDINT as: a category of intelligence activity resulting from the collection, evaluation, analysis and interpretation of data on foreign medical and scientific information, as well as those related to the environment, which are of importance in the strategic and military-medical planning of operations for the purposes of preserving the combat effectiveness of friendly forces and for making assessments of foreign-enemy medical capacities in the military and civilian sectors. (Dept. of Defense I-02, 2016) NATO gives the following definition of MEDINT, seeing it as: "the product of collection, evaluation, analysis, interpretation and dissemination of foreign medical, epidemiological, scientific-biological, ecological and other information that is related with human and animal health". (NATO AJP-4.10, 2011) However, the modern exploitation of this term implies a form that does not

belong to the security vocabulary, and refers to its commercial application in the domain of personalized medicine.

Part of the existing conceptual inconsistency and overlapping in regard to the meaning of MEDINT is primarily a consequence of the fact that today there is no clear consensus regarding the essential competence of the military and civil services in the domain of public health and its endangerment by the use of WMD, including biological weapons, as well as the issue of whether and to what extent we can equate the concepts of biological warfare with, biological terrorism, biocriminal activities or bioaccidents (Carus, 2001). It is also an open question whether MEDINT focuses exclusively on issues related to endangering the health of members of the military and security services or the health of all citizens of the country or a certain region. Finally, the question is also can we include in the same definition the indirect endangerment of human health, as well as the entire society, if we are talking about the impact on agricultural resources and the environment. From all of the above, it is clear that human health in the broadest context can be threatened through the entire spectrum of direct and indirect influences. That is why the precise conceptual definition of the term MEDINT is significant not only in the theoretical and academic sense, but also in the practical sense, because numerous problems could arise in the later operative work, concerning the overlapping competences, responsibilities and models of cooperation between different entities of the state intelligence and security sector and different institutions dealing with public health, public safety, environmental protection, animal health, agronomy, etc. (Kokoškov & Ristanović, 2019).

Initially, during the Second World War, MEDINT dealt with the recognition and analysis of non-combat factors endangering the army (infectious diseases, water and food sanitation, microclimatic influences, etc.). The analysis of the enemy's medical status, its capacity to treat and care for the injured was also part of their interest. The Americans and the Soviets soldiers in the Asian continent firstly indicated the evident use of biological weapons by the Japanese Unit 731 on the territory of China (Guillemin, 2004). These and other findings opened up another significant dimension of MEDINT, namely its integrative

application in relation to the growing phenomenon of biological warfare (Wolf, 1996).

Ever since the Second World War, through the Cold War and the subsequent expansion of non-conventional forms of security threats, to the biotechnology revolution and the current global distribution of security-risk technologies and dual-use materials, the transformations of MEDINT have actually been a good indicator of how security communities adapt to the dynamics and character of new challenges and threats (Jarcho 1991, Clemente 2013).

It is important to emphasize that the classic action of the military intelligence community against the biological threat have been primarily related to the collection of information on foreign combat systems, equipment and means intended for possible offensive action with biological weapons and for the assessment of their defensive capacities (Kostadinov & Kanev, 2009).

In addition, MEDINT have also played a vital role in the planning of military operations, especially in the areas that are different in terms of their epidemiological, climatic, ecological, geographical and other characteristics from the environment in their domicile countries. Today, the military MEDINT also supports the engagement of military personnel in peacekeeping missions or conflict hotspots, where in the intelligence sense it focuses on the preparation of assessments and analyzes of the existing medical infrastructure "on the ground", as well as the assessment of the health risks of military personnel, including the risks to the people and their environment after their returning to the home country. In this context, it is particularly important to know the risk of endemic diseases with long incubation period, latent clinical course or completely asymptomatic form of infection, which could threaten the health of the environment after the return of soldiers to their home country (Kokoškov, 2021).

The end of the Cold War led to the transformation of the traditional concept of warfare into new conflict forms with a more dominantly expressed power asymmetry of the participants. In this sense, classic warfare, with the use of conventional weapons, no longer represents a dominant form of security threat. The use of unconventional weapons or the use of conventional weapons but in an

unconventional way, the actions of sub and trans-national subjects of security threat, with a pronounced conflict asymmetry, are perhaps the key features of modern conflicts in the world. That is why the existing military and defense doctrines had to evolve in accordance with the new security trends.

After September 11, 2001, experiences with anthrax letters in the USA, intelligence knowledge of Al Qaeda's plans to use biological and chemical weapons (Carus, 2001, Koblentz, 2006), as well as previous episodes with the apocalyptic sect Aum Shinrikyo in Japan (Tucker 2000), the intelligence and security communities around the world were introduced to a new security reality that has become more and more actualized in recent years, as well as considerations about the possible use of WMD, especially biological and chemical by non-state threat actors. In the context of newly recognized security risks, the possibility of some covert form of providing support to certain state entities that have developed capacities for the production of biological/chemical weapons was not neglected either. From the historically outmoded concept of biological/chemical warfare, the current focus of the security community, has been redirected to biological terrorism, counter-terrorism and counter-proliferative action (Kostadinov & Kanev, 2009).

The targeted triggering of epidemics, pandemics or, for example, mass poisonings are increasingly being considered by security analysts as possible scenarios for endangering human health. It is certainly difficult to limit these hypothetical assessments only to the national frameworks of the leading countries in the world, because epidemics and pandemics are health phenomena that are as transnational as modern organized crime or terrorism, which, after all, have been best demonstrated by the COVID-19 pandemic (Britten, 2022).

Planning, implementation, and especially the consequences of induced mass infections of people (or plants and animals) do not recognize national borders. In this sense, the international dimension of these security threats simply imposes the need to develop regional and wider international cooperation arrangements of intelligence and security communities in their anticipation, prevention, defense and elimination of consequences (Petro, 2004).

Prevention of health crises with the establishment of a system for biological preparedness, includes the development of effective systems and measures for defense and elimination of consequences of the crisis situation arising from the action of biological and chemical agents (BA/CA), can be successfully implemented only with a thorough intelligence and security work.

As it was previously pointed out, agro-terrorism is the intentional causing of plant or animal diseases, as well as planned attacks on food and water supply systems, using biological or chemical agents, with the intention of causing economic losses, disrupting social stability and causing fear (Ryan&Glamur, 2008). Agroterrorism can be considered a threat with a relatively high probability of realization due to a whole series of characteristics, such as: "soft targets" of final action (unprotected agricultural crops and livestock production), very complex and untimely detection of attacks (it is difficult to recognize natural from artificially caused diseases of plants and animals), diversity of means of action (existing or modified biological/chemical agents), "safe work" for the perpetrators themselves (the application of the disease causative agent is almost impossible to recognize, especially if the existence of the incubation period is taken into account). One of the most significant features of agro-terrorism is the causing of major health, economic and socio-psychological consequences. In the professional and academic literature, agro-terrorism is often described with the wording economic terrorism, precisely because of the huge possible direct and indirect material consequences for the state. However, the term economic terrorism is more suitable and can be used for any type of biological threat. The representatives of the security community must point out the danger of agro-terrorism to national defense strategists and policy leaders and to initiate the establishment of a preventive-deterrence system for the protection of agricultural assets (Kostadinov & Kanev, 2009; Kokoškov, 2021).

Ecological terrorism, ecological accidents and ecological crime are security phenomena that have already been introduced into certain national security matrices. In this sense, integrative MEDINT, as an intelligence concept, can only contribute to an even better and more efficient protection of both the

agroindustry and the environment as a whole (Ministry of Defense USA-Headquarters Dept. of the Army, 1994).

VIP health is a special category within the framework of modern civilian MEDINT and it deals with intelligence processing of data concerning potential impacts on the health of prominent individuals in society. Their endangerment, given their political power, status and social influence, could cause socio-political disturbances and instability in the state, as well as significant international friction. Impairment of the health of important individuals can affect their cognitive and intellectual abilities, that is, in the last instance, their leadership capacities. All these could result in atypical behavior, temporary or permanent inability to work, making of irrational decisions with potential consequences for national interests and security. The most radical outcome could be a lethal effect with all possible consequences for national and international security (Podbregar & Ivanuša, 2011).

In the intelligence sense, MEDINT also deals with the creation of specific health profiles of the highest national importance persons (statesmen, prominent public figures, etc.). It should be noted that in more developed intelligence communities there is a praxis of health profiling of foreign political leaders, especially if there is an active bilateral or multilateral activity in which knowledge of the health characteristics of the participants in the dialogue is particularly important (Ministry of Defense USA-Headquarters Dept. of the Army, 1994).

Taking everything mentioned into account, we can conclude that in the intelligence and security sense, the health status of the most influential people in the country is significant both from the intelligence and counterintelligence aspects. The production of a quality intelligence product, useful for risk assessments for certain forms of threats, enables various segments of society including the entities recognized as "critical infrastructure of society" to design and format their systems according to that threat assessment. In this sense, every preventive action of the national defense-intelligence systems, among which MEDINT has a very important role is of immeasurable significance. Its

contribution to international cooperation in this domain is also significant (Natarajan, 2007).

The prioritization of the significance of *open sources intelligence* (OSINT) as the most important method for data collection today differs MEDINT from most other intelligence platforms. The existing information revolution has enabled free access to a huge database that is continuously updated. This fact indicates the special importance of expertise criteria in the selection of intelligence professionals engaged not only in the collection but also in further evaluation and analytical processing of input data and raw information within the intelligence cycle (Robert, 2004).

Apart from OSINT, practically all other methods and techniques of intelligence work can be applied within the scope of MEDINT in order to complete and verify obtained information. Analytical activity within the framework of MEDINT is based on an expert assessment of numerous and very diverse factors that can affect health. Risks of epidemics or even pandemics, deficit or contamination of food and/or water, lack of health care (medicines, vaccines, etc.), endangerment of agricultural resources, negative demographic trends, as well as the regional and global distribution of those influences are a kind of input "substrate" from which intelligence and security analytics produce final information. Thus, the expertise and multidisciplinary cooperation and connection are very important for the operative, as well as the analytical segment of MEDINT, which opens up the possibility of obtaining a quality analytical insight into the collected data, their proper evaluation and finally, the possibility of their further use (Jonathan, 2013).

The issue of risk of potential genetic engineering and biotechnology misuse for the generation of new and more dangerous bioweapons is one the most complex challenges in the frame of intelligence prevention against endangering the "health of the nation". The possible modifications of the properties of microorganisms refer to increased pathogenicity and virulence, high resistance to antibiotics and vaccines as well as to external influences, changing of the tissue tropisms, changing of their antigenic properties, etc. In this sense, MEDINT

would have to undertake security monitoring of the most innovative research and development projects in the field of molecular biology and genetic engineering, as well as their commercial application (Kokoškov, 2021). However, this opens a "Pandora's box" because it calls into question the legitimacy and professional competence of the intelligence community to assess the risks and dangers brought by the most modern research, especially if it limits the freedom and creativity of experts in the scientific work, which has already been discussed previously. In addition to special expert knowledge, this approach and activity also requires the application of new analytical tools and skills that would contribute to obtaining a quality intelligence product (Jonathan, 2013).

However, the phenomenon of "dual use" does not refer only to innovative scientific and research work, but also to the daily exploitation of numerous technologies and materials both in industry and in everyday life. These activities have not only a practical, i.e. useful value, but also carry certain risks of abuse. Those risks are primarily related to the possibility of making and using chemical and/or biological weapons. In addition, security characterization and action to prevent misuse of dual-use technologies and materials, which is further complicated by their increasing availability and global distribution, both in various commercial programs and in everyday life. Therefore, in a practical sense, this area of intelligence-security work would require the engagement of highly sophisticated experts from relevant scientific and professional fields and their introduction into the classic intelligence cycle (selection of raw information, their evaluation and analysis) (Selgelid, 2010). Hypothetically speaking, persons who are directly connected with dual-use technologies, either through professional training, scientific research and development work or as a part of commercial plants, are certainly in the zone of special interest for the security community (Simon, 2013). The operationalization of MEDINT in state systems dealing with research or the application of dual-use technologies also opens up the issue of counterintelligence protection of people who may be exposed to various methods of intelligence processing by a foreign factor.

In the absence of a precise formal foundation in legal documents and organizational acts, it is practically very difficult to achieve any inter-institutional connection in the field of public health with subjects of the public security and intelligence-security sector of the state. The launch and development of an integrative MEDINT at the national level would certainly therefore have to be one of the priority tasks, in accordance with the characteristics of the state and its political, security, economic and geopolitical status. It would also have to be dimensioned in accordance with the estimated security challenges and threats to which the state is exposed, as well as threats to the international peace and security (Kokoškov & Ristanović, 2019).

As already mentioned, the most significant peculiarity of MEDINT compared to other areas of intelligence work is that a huge mass of raw data and information is drawn from numerous and very diverse open sources (OSINT), which are introduced into the classic intelligence cycle. For the proper processing of raw information, the intelligence cycle of MEDINT requires top analysts capable of analyzing diverse input data through various analytical techniques and placing them in a unique security context. This raises the question of whether the civil intelligence and security apparatus has experts capable of valorizing and analytically processing raw intelligence data and information related to people's health. If necessary, their deficit could be compensated through possible cooperation with other subjects of the state's intelligence apparatus (from the military sector) or through the introduction of experts of various specialist profiles who are employed in specialized institutions that basically belong to "civil society" (Kokoškov & Ristanović, 2019).

It remains for the security community to develop a special model of their integration, guided by the principles of very careful selection of people, their gradual introduction into the system, with previously precisely defined internal work procedures. The functional integration of highly specialized experts from civil society (epidemiologists, epizootologists, toxicologists, bioinformaticians, molecular geneticists, environmental safety engineers, phytopathologists, etc.) into the intelligence and security apparatus brings the necessary multidisciplinary

expertise that is required for high-quality and efficient work within MEDINT. Training of intelligence officers/operatives with complex medical and biological knowledge is too complex and time-consuming process with uncertain result. "It is incomparably easier to teach a doctor or an expert in the natural sciences about intelligence work than it is to teach an intelligence officer about medicine or biology" (Kaufman, 2011).

The theoretical assumption according to which endangering the health of people, animals, plants, as well as the preservation of the environment are considered non-traditional and non-conventional security issues, certainly makes it difficult to introduce them into future strategic planning and development frameworks within the intelligence and security community. Careful monitoring of modern security trends with their good anticipation and the necessary positive personal attitudes of function holders in the management segment of the political and intelligence community are necessary in the initiation and development of an integrative MEDINT that would act proactively in the context of recognizing and responding to current and potentially new security threats (Colf, 2016).

The key characteristics of MEDINT within the intelligence-security corps of a country would be expertise, multidisciplinarity and integrative character. Therefore, it is necessary to achieve a good connection with other relevant segments within the intelligence and security apparatus of the state, as well as functional inter-institutional integration with other reference entities from the public health system, state administration and civil society. Finally, MEDINT would have to be open to international cooperation considering the transactional dimension of the threats it deals with (Natarajan, 2007).

In the end, MEDINT, like any other intelligence-security (sub)systems, should not be seen as a rigid and static creation, but exclusively as a dynamic system capable of being introduced into the process of adapting to the security reality. Its formatting, development dynamics and efficiency certainly depend on a whole range of factors. Any delay in this regard is an irreparable waste of time for a responsible state that cares about the safety of its citizens, especially in the

current moment of growing security threats, among which medical-biological ones, have a special place.

5. CONCLUSIONS

Based on all of the above, it is clear that there is a need to strengthen the plan of a coordinated and defined international response to biological threats, which includes preventive, surveillance and control mechanisms, as well as the adequate response in case of biological threats. Taking into account that in the existing security architecture of the world, the risk of using WMD, including biological weapons, is becoming greater (Ristanović, 2016), as well as all previous experiences, but also the possible consequences of its application, both in war and in bioterrorist acts, as well as through epidemics, pandemics and their possible consequences, it is clear that it is necessary to strengthen, first of all, international cooperation in this domain, which must be based on a genuine, impartial, dedicated and professional approach and must represent a joint obligation and responsibility of all actors on the international stage. All this must be coordinated within the UN security system, whose role in this segment needs to be reaffirmed in accordance with the challenges of the times. This is clearly demonstrated by the recent experience of the COVID-19 pandemic, as well as the issues of biological research that have become the subject of sharp polemics and confrontations between the leading powers of the time, while everyone would suffer the potential consequences.

Precisely in this context, based on the set goals and defined research questions, after an extensive analysis of the current moment, which represents a turning point in the future determination of the world, and an analysis of available relevant sources and experiences, the following conclusions can be clearly formulated:

a) The Biological Convention, signed exactly 50 years ago, is much more important today than ever before. It cannot remain only a declarative act,

nor a legal-political framework, but it must represent a relevant international document that must always be critically reviewed, refined and changed. The Convention must produce certain effects, binding not only for its signatories and depositors, but also for all subjects on the international stage. A critical look at the existing provisions of the Convention points to deficiencies that must be corrected, which enable omissions and violations of non-proliferation multilateral regimes by states, including first of all the most powerful, as well as non-state actors, scientific and economic subjects, but also terrorist organizations and groups. Therefore, it is extremely important to reaffirm the role of the UN, as the final arbiter in the context of preventing possible abuse, as well as strengthening and controlling non-proliferative regimes related to the use of WMD, especially biological weapons, which today can be considered a strategic threat. In this context, the tasks and obligations of all actors on the international and national scenes must be clearly defined and become the subject to truly independent and impartial monitoring.

b) As this research shows, the biggest problems of the Biological Convention are related precisely to the lack and failure in the existence of objective verification measures that would enable constant monitoring and supervision and determine the existence of non-compliance or violation of the provisions of the Convention. All that mentioned include the necessity of applying multidisciplinary expert knowledge, based on postulates of objective science, responsibility, independence, impartiality, as well as executive powers that can only be reached through the formation of a special expert body ***Organization for the Prohibition of Bacteriological (Biological) and Toxin Weapons (OPBW)*** under the direct jurisdiction of the UN Security Council. Of course, the question arises as to why the same was not constituted earlier, as it happened in the case of chemical or nuclear weapons, and whether the political will of the most powerful, along with the lack of awareness of the threat posed by biological

weapons, decisively contributed to the fact that such a body has not yet been constituted under the UN system.

c) The development of science, especially molecular biology, genetic engineering, biotechnology and nanotechnology, opened the way to the understanding of life processes at the fundamental level, as well as the clarification of evolutionary processes, the understanding of immunopathogenetic mechanisms, unimagined possibilities in terms of diagnostics, prevention and prophylaxis of numerous diseases. On the other hand, it opened the way for the possible misuse of this knowledge, which can be directed to the creation of dangerous and deadly biological weapons, which can act on the genome of people, even selectively on a certain nation, population, target group. The development of technology also opens up unsuspected possibilities of its abuse in order to develop and adapt systems for the dissemination of biological agents, including, for example, modern drones and other means. Preventing the potential abuse of science must be a matter of legal regulation at the international and national levels, as well as possible sanctions, but also an appropriate code of ethics of the scientists themselves and the biomedical profession in general. The greatest responsibility in this context lies with the most technologically superior and powerful states, but these areas would be precisely defined in the context of the obligations of the previously mentioned independent international expert body under the jurisdiction of the UN. This does not exclude the need to strengthen awareness of this problem at the level of States Signatories, but also other countries that must take measures based on a multidisciplinary approach, cooperation and strengthening capacities for biological defense, as well as the necessity of educating scientists in order to raise awareness of the possible abuse of their work, as well as the promotion and affirmation of the provisions of the BWC and its sincere application.

d) The free movement of people, information, goods, services and capital increases the availability of potentially dangerous substances and creates a favorable environment for increasing the likelihood of misuse of dual-use commodities, i.e. unauthorized transfer of technologies by groups, non-state actors or individuals in order to develop and use WMD as a transnational asymmetric security threat and its application as a threat to international peace and security. In this context, biological weapons and the means for their application have numerous specificities in relation to other types of WMD. So, the special attention must be paid to BW regarding their specific features (e.g. easy availability and presence in nature all around us, the possibility of their application in human and veterinary medicine, agriculture, pharmaceutical, food industry, agro-engineering etc.). In this context, it is not possible to establish a control regime for BW that is specific for other types of WMD. However, numerous international regulations exist in this area and their implementation is of particular importance, by creating assumptions for the effective control of any type of arms and dual-use commodity traffic, including the electronic transfer of software and technology, which can be used in the production of WMD and means for their transmission and dissemination. Different subjects - governments, industry, science, public health, the security system, as well as the general public must be part of a joint program that has different organizational levels, ensuring that biotechnology and its benefits are equally accessible throughout the world and used for the common good of all people.

e) The intelligence-security aspect is extremely important in the prevention of potential biological endangerment at the national, regional and international level, and within that, special attention should be paid to MEDINT as an important tool for monitoring the epidemiological-epizootological situation on the ground, development of capacities for the biological research and concerning on its eventual abuse, possession of

appropriate equipment and professional staff, as well as research interest in the context of the specificity of certain populations that may become subject of biological threats. In this segment, it is important to have trained experts who, along with professional knowledge, must have knowledge of the necessary intelligence-security procedures. And in this context, international cooperation and exchange of information is extremely important in order to prevent biological threats and strengthen the global security.

Considering the achieved development of science and the current contradictions that exist in the security architecture of the world, which, as said, changes rapidly and dynamically, one of the biggest security threats in the 21st century is certainly the possibility of the outbreak of biological and IT warfare. Therefore, the creation and legal regulation of measures sanctioning the violation of the Biological Convention, including legal prohibitive measures and sanctions related to research, development, technical and financial support, storage, transfer, acquisition and use of potential biological agents, as well as internal mechanisms which reveal and determine the violation of the Convention is certainly extremely important in the national framework, but even more important is the constitution of an international expert body under the jurisdiction of the UN that would cover all the discussed segments and expand them to the international framework, thus ensuring the formation of a safer world of equal peoples and states.

6. REFERENCES/LITERATURE

1. AHG, B. (2001). *Rolling Text of a Protocol to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction.* Geneva, BWC/Ad Hoc Group/56-1. Online, available at: www. brad. ac. uk/acad/sbtwc/doc56-1. pdf Accessed: 18 March, 2022
2. Alberque, W. (2022). *The US Arms Control Agenda: Impact on Europe.* In Arms Control and Europe (pp. 9-20). Springer, Cham.
3. Anderson, D. G. (1991). The International Arms Trade: Regulating Conventional Arms Transfers in the Aftermath of the Gulf War. *Am. UJ Int'l L. & Pol'y*, *7*, 749.
4. Army, U. S. (1989). *FM 8-10-8, Medical Intelligence in a Theater of Operations*, July 1989.
5. Asada, M. (2008). Security Council Resolution 1540 to combat WMD terrorism: effectiveness and legitimacy in international legislation. *Journal of Conflict & Security Law*, *13*(3), 303-332.
6. Ashcheulova, T., & Ambrosova, T. (2021). Dual-use technologies of concern in context of biosafety. *Inter Collegas*, 8(1), 4-9.
7. Atlas, R. M., & Dando, M. (2006). The dual-use dilemma for the life sciences: perspectives, conundrums, and global solutions. *Biosecurity and bioterrorism: biodefense strategy, practice, and science*, 4(3), 276-286.
8. Barenblatt, D. (2004). *A plague upon humanity: The secret genocide of axis Japan's germ warfare operation.* New York: Harper Collins.
9. Barras, V., & Greub, G. (2014). History of biological warfare and bioterrorism. *Clinical Microbiology and infection*, 20(6), 497-502.
10. Beard, J. M. (2007). The shortcomings of indeterminacy in arms control regimes: The case of the Biological Weapons Convention. *American Journal of International Law*, 101(2), 271-321.
11. Beauchamp, T. L., & Childress, J. F. (2001). *Principles of Biomedical Ethics (5th edition)* In. Oxford University Press.

12. Becker, J. U., Theodosis, C., & Kulkarni, R. (2008). HIV/AIDS, conflict and security in Africa: rethinking relationships. *Journal of the International AIDS Society*, *11*(1), 1-7
13. Berger, K., Wlinetz, C., McCarron, K., You, E., & So, W. (2012). Bridging Science and Security for Biological Research: A Dialogue between Universities and the Federal Bureau of Investigation. *Report of a Meeting* February 21–22, 2012.
14. Biological and Toxin Weapons Convention (BTWC). Available at: http://www.opbw.org/ Accessed: 13 June, 2022
15. Bishop, L. J., & Nolen, A. L. (2001). Animals in research and education: Ethical issues. *Kennedy Institute of Ethics Journal*, 11(1), 91-112.
16. Block, S. M. (2001). The Growing Threat of Biological Weapons: The terrorist threat is very real, and it's about to get worse. Scientists should concern themselves before it's too late. *American Scientist*, 89(1), 28-37.
17. Børsen Hansen, T. (2006). Academic and social responsibility of scientists. *ISYP Journal on Science and World Affairs*, 2(2), 71-92.
18. Boyle, F. A. (2020). SARS-COV-2 is a biological warfare weapon. *Bezbednosni dijalozi*, *11*(2), 21-29.
19. Britten, S. (2022). *Terrorism and biological weapons. In COVID-19 Pandemic: The Threat and Response* (pp. 147-158). Routledge.
20. Brown, V. R., Miller, R. S., McKee, S. C., Ernst, K. H., Didero, N. M., Maison, R. M., ... & Shwiff, S. A. (2021). Risks of introduction and economic consequences associated with African swine fever, classical swine fever and Foot and Mouth disease: A review of the literature. *Transboundary and emerging diseases*, *68*(4), 1910-1965.
21. Buchanan, A., & Kelley, M. C. (2013). Biodefence and the production of knowledge: rethinking the problem. *Journal of Medical Ethics*, 39(4), 195-204.
22. BWC MX5 (2019). Report of the 2019 Meeting of Experts on Institutional Strengthening of the Convention. Available online at: https://undocs.org/BWC/MSP/2019/mx,0.5/2 Accessed: 9 May 2022

23. Canada, et al. (2017a). International Activities of Global Partnership Member Countries related to Article X of the Biological and Toxin Weapons Convention. Available online at: https://undocs.org/BWC/MSP/2017/WP.17 Accessed at: 6 June, 2022
24. Canada, et al. (2017b). Responding to Deliberate Biological Release: The Requirements for Effective, Coordinated International Action. Available online at:https://undocs.org/BWC/MSP/2017/WP.20 Accesed:May,6,2022
25. Carus, W. S. (2001). *Bioterrorism and biocrimes: the illicit use of biological agents since 1900.* Washington DC: Center for Counter proliferation Research at National Defence University, Revisited edition.
26. Carus, W. S. (2015). The history of biological weapons use: what we know and what we don't. *Health Security*, 13(4), 219-255.
27. Casadevall, A. (2017). Don't forget the fungi when considering global catastrophic biorisks. *Health Security*, 15(4), 341-342.
28. Cello, J., Paul, A. V., & Wimmer, E. (2002). Chemical synthesis of poliovirus cDNA: generation of infectious virus in the absence of natural template. *Science*, 297(5583), 1016-1018.
29. Central Intelligence Agency Directorate of Intelligence (2003). *The darker bioweapons future*. OTI SF 2003–108. Available at: http://www.fas.org/irp/cia/product/bw1103.pdf. Accessed: May, 11, 2022.
30. Chen, Y., Yin, Z., Shao, Z., & Xie, Q. (2015). The Defence of Artificial Life by Synthetic Biology from Ethical and Social aspects. *J Coll Physicians Surg Pak*, 25(7), 519-524.
31. Chevrier, M. I. (1995). From verification to strengthening compliance: prospects and challenges of the Biological Weapons Convention. *Politics and the Life Sciences*, 14(2), 209-219.
32. Christopher, L. G. W., Cieslak, L. T. J., Pavlin, J. A., & Eitzen, E. M. (1997). Biological warfare: a historical perspective. *JAMA*, 278(5), 412-417.

33. Cirincione, J., Wolfshal, J. B., & Raikumar, M. (2005). *Deadly Arsenals: Tracking Weapons of Mass Destruction.* Carnegie Endowment for International Peace. Ed. 2.
34. Citaristi, I. (2022). *United Nations Office for Disarmament Affairs—UNODA. In The Europe Directory of International Organizations 2022* (pp. 244-246). Routledge.
35. Colf, L. A. (2016). Preparing for nontraditional biothreats. *Health Security*, 14(1), 7-12.
36. Committee on Research Standards and Practices to Prevent the Destructive Application of Biotechnology. (2004). *Biotechnology Research in an Age of Terrorism: Confronting the"" Dual Use"" Dilemma.* National Academies Press.
37. Danelyan, A. A., & Gulyaeva, E. E. (2022). Problems of biosafety in current international law. *Moscow Journal of International Law*, (2), 66-84.
38. Danzig, R. (2012). *Innovation, dual use, and security: managing the risks of emerging biological and chemical technologies*. MIT press.
39. DaSilva, E. J. (1999). Biological warfare, bioterrorism, biodefence and the biological and toxin weapons convention. *Electronic Journal of Biotechnology*, 2(3).
40. Department of Defence (2016). *Dictionary of Military and Associated Terms.* USA, Join Publication 1-02, p.150
41. Douglas, T., & Savulescu, J. (2010). Synthetic biology and the ethics of knowledge. Journal of medical ethics, 36(11), 687-693.
42. Drobysz, S. (2020). Verification and implementation of the Biological and Toxin Weapons Convention. The Nonproliferation Review, 27(4-6), 487-497.
43. Dunworth, T., Mathews, R. J., & McCormack, T. L. (2006). National implementation of the biological weapons convention. Journal of Conflict and Security Law, 11(1), 93-118.
44. Elbe, S. (2020). *Strategic implications of HIV/AIDS*. Routledge.

45. Edwards, B., Novossiolova, T., Crowley, M., Whitby, S., Dando, M., & Shang, L. (2022). Meeting the challenges of chemical and biological weapons: strengthening the chemical and biological disarmament and non-proliferation regimes. *Frontiers in Political Science*, 15.
46. Edwards, D. A. (2002). Delivery of biological agents by aerosols. American Institute of Chemical Engineers. *AIChE Journal*, 48(1), 2.
47. Edwards, D. A., Hanes, J., Caponetti, G., Hrkach, J., Ben-Jebria, A., Eskew, M. L., ... & Langer, R. (1997). Large porous particles for pulmonary drug delivery. *Science*, 276(5320), 1868-1872.
48. Ehni, H. J. (2008). Dual use and the ethical responsibility of scientists. *Archivum immunologiae et therapiae experimentalis*, 56(3), 147-152.
49. Eneh, O. C. (2012). Biological weapons-agents for life and environmental destruction. *Research Journal of Environmental Toxicology*, 6(3): 65-87.
50. Enemark, C. (2010). The role of the Biological Weapons Convention in disease surveillance and response. *Health Policy and Planning*, 25(6), 486-494.
51. Faden, R. R., & Karron, R. A. (2012). The obligation to prevent the next dual-use controversy. *Science*, 335(6070), 802-804.
52. Feakes, D. (2017). The Biological Weapons Convention. *Revue Scientifique et Technique (International Office of Epizootics)*, 36(2), 621-628.
53. Flahault, A., & Zylberman, P. (2010). Influenza pandemics: past, present and future challenges. *Public Health Reviews*, *32*(1), 319-340.
54. Gerstein, D. M. (2013). *National security and arms control in the age of biotechnology: the Biological and Toxin Weapons Convention*. Rowman & Littlefield Publishers.
55. Gibson, D. G., Glass, J. I., Lartigue, C., Noskov, V. N., Chuang, R. Y., Algire, M. A., ... & Venter, J. C. (2010). Creation of a bacterial cell controlled by a chemically synthesized genome. *Science*, 329(5987), 52-56.

56. Gigi, K.G.(2012).*Preparing for Bioterrorism.* Baltimore, MA: Center for Biosecurity of UPMC
57. Goldblat, J. (1986). The role of the United Nations in arms control: An assessment. *Contemporary Security Policy*, 7(2), 115-132.
58. Goldblat, J. (1997). The Biological Weapons Convention: An overview. *International Review of the Red Cross* (1961-1997), 37(318), 251-265.
59. Goldblat, J. (2021). *Arms control agreements: A handbook (Vol. 5).* Routledge.
60. Goldsmith, J. L., & Posner, E. A. (2005). *The limits of international law*. Oxford University Press.
61. Graham, D. B., & Root, D. E. (2015). Resources for the design of CRISPR gene editing experiments. *Genome biology*, *16*(1), 1-21.
62. Grmek, M.D. (1979). Les ruses de guerre biologiques dans l'Antiquite. *Rev Etud Grec*, 92: 141–163. (In English)
63. Guillemin, J. (2004). *Biological Weapons: From the invention of state-sponsored programs to contemporary bioterrorism.* Columbia University Press.
64. Gutmann, A., & Wagner, J. (2010). *New directions: The ethic of synthetic biology and emerging technologies.* Presidential Commission for the Study of Bioethical Issues, Washington, December, 2010
65. Heinonen, O. (2016). Lessons learned from dismantlement of South Africa's biological, chemical, and nuclear weapons programs. *The Nonproliferation Review*, 23(1-2), 147-162.
66. Hersman, R. K., Williams, H., & Claeys, S. (2022). *Integrated Arms Control in an Era of Strategic Competition.* Rowman & Littlefield.
67. Heukelbach, J., Alencar, C. H., Kelvin, A. A., de Oliveira, W. K., & de Góes Cavalcanti, L. P. (2016). Zika virus outbreak in Brazil. *The Journal of Infection in Developing Countries*, *10*(02), 116-120.
68. Huigang, L., Menghui, L., Xiaoli, Z., Cui, H., & Zhiming, Y. (2022). Development of and prospects for the Biological Weapons Convention. *Journal of Biosafety and Biosecurity*, 4(1), 50-53.

69. Jackson, R. J., Ramsay, A. J., Christensen, C. D., Beaton, S., Hall, D. F., & Ramshaw, I. A. (2001). Expression of mouse Interleukin-4 by a recombinant Ectromelia virus suppresses cytolytic lymphocyte responses and overcomes genetic resistance to mousepox. *Journal of Virology*, 75(3), 1205-1210.
70. Jain, A. K. (2010). Ethical issues in scientific publication. *Indian journal of orthopaedics*, 44(3), 235-237.
71. Jarcho, S. (1991). Historical perspectives of medical intelligence. *Bulletin of the New York Academy of Medicine*, 67(5), 501-506.
72. Jeffrey, S.D. (2013). *Lone Wolf Terrorism, Understanding a Growing Threath*. Prometheus books
73. Johnston, M. P. (2017). Secondary data analysis: A method of which the time has come. *Qualitative and quantitative methods in libraries*, 3(3), 619-626.
74. Jonas, O. (2013). *Pandemic Risk*. In: World Development Report 2014 on Risk and Opportunity: Managing Risks for Development, World Bank.
75. Jonathan, C.D. (2013). Medical Intelligence: Guide to the Study of Intelligence. *Intelligencer-Journal of U.S.Intelligence Studies*, 20(2):73-78
76. Jonathan, T. (1995/2000) *Toxic Terror-Assessing Terrorist Use of Chemical and Bioogical Weapons*. In: David Caplan, Aum Shinrikyo [Ed.] BCSIA Studies in International Security, Cambridge, Massachusets: Monterey Institute, p. 207-227
77. Joshi, S., & Stein, A.(2013).Emerging drone nations.*Survival*,55(5),53-78.
78. Kaiser, J. (2005). Resurrected influenza virus yields secrets of deadly 1918 pandemic. *Science*, 310(5745), 28-29.
79. Kallenborn, Z., & Bleek, P. C. (2018). Swarming destruction: drone swarms and chemical, biological, radiological, and nuclear weapons. *The Nonproliferation Review*, 25(5-6), 523-543.
80. Kaufman, D. C. (2001). *Medical Intelligence: A Theater Engagement Tool. Carlisle Barracs, OA: U.S.Army War College-DIA,* P. 17013-5050, Strategy Research Project

81. Kelle, A. (1997). Developing control regimes for Chemical and Biological Weapons. *The International Spectator*, 32(3-4), 137-157.
82. Kelle, A. (2022). *Prohibiting Chemical and Biological Weapons*. In: Prohibiting Chemical and Biological Weapons. Lynne Rienner Publishers.
83. Khripunov, I. (2014). A work in progress: UN Security Resolution 1540 after 10 years. *Arms Control Today*, *44*(4), 39.
84. Koblentz, G. D. (2009). *Living Weapons: Biological Warfare and International Security*. Cornell University Press, Ithaca and London. ISBN 978-0-8014-4768-6
85. Kokoškov, N. S. (2021). Medical intelligence and its perspectives in the post COVID-19 era. *Romanian Intelligence Studies Review*, (26), 5-20.
86. Kokoškov, N., & Ristanović, E. (2019). Medical intelligence, its importance and perspectives in the security-intelligence community of the Republic of Serbia. *Bezbednost*, 61(1), 89-109.
87. Kostadinov, R., & Kanev, K. (2009). *Medical Intelligence as a Tool Enhancing Situational Awareness*. Military Medical Academy, Sofia (Bulgaria).
88. Kuhlau, F., Eriksson, S., Evers, K., & Höglund, A. T. (2008). Taking due care: Moral obligations in dual use research. *Bioethics*, 22(9), 477-487.
89. La Gioia, V. (2015). *Medical Intelligence in Biological Issues*. In: Biosecurity&Biosafety: Future Trends and Solutions, Centro Intelligence Interforze, Col. ITAF
90. Leach, B. (2021). Necessary Measures: Synthetic Biology & the Biological Weapons Convention. *Stanford Technology Law Review*, 25(1):141-165
91. LeClaire, R. D., & Pitt, M. L. M. (2005). *Biological Weapons Defense*. In: Biological Weapons Defense (pp. 41-61). Humana Press.
92. Lee, H. W. (1989). Hemorrhagic fever with renal syndrome in Korea. *Reviews of infectious diseases*, *11*(Supplement_4), S846-S876.
93. Leitenberg, M. (2001). Biological Weapons in the twentieth century: a review and analysis. *Critical Reviews in Microbiology*, 27(4), 267-320.

94. Leitenberg, M., Zilinskas, R. A., & Kuhn, J. H. (2012). *The Soviet biological weapons program*. In: The Soviet Biological Weapons Program. Harvard University Press.
95. Lentzos, F. (2018). Strengthen the taboo against biological and chemical weapons. *The Bulletin of Atomic Scientists.* Available at: https://thebulletin.org/2018/07/strengthen-the-taboo-against-biological-and-chemical-weapons/?utm_source=Twitter&utm_medium=TwitterPost&utm_campaign=Taboo_July26 Accessed: April,21, 2022
96. Lentzos, F. (2019a). Re-Thinking Biological Arms Control for the 21st Century. *Fletcher Sec. Rev.*, 6:33-36.
97. Lentzos, F. (2019b). *Trust and Transparency in Biodefense*. In Singh, K. and Kuhn, J.H (eds). Defense Against Biological Attacks: Volume I. pp. 53–68.
98. Lentzos, F. (2020a). Dual-use biology: building trust and managing perceptions of intent. *The Nonproliferation Review*, 27(4-6), 517-523.
99. Lentzos, F. (2020b). How to protect the world from ultra-targeted biological weapons. *Bulletin of the Atomic Scientists*, 76(6), 302-308.
100. Littlewood, J. (2010). The verification debate in the Biological and Toxin Weapons Convention in 2011. *Disarmament Forum*, 3:15-25.
101. Littlewood, J. (2018). *Revisiting BWC Verification: Peaceful Cooperation". Policy Brief Series to BWC MX5. Second BWC Review Conference*. BWC/CONF.II/13. 30 December 1986.
102. Loch, J.K. (2002). *Bombs, Bugs, Drugs and Thugs-Intelligence and America's Quest for Security.* NY:New York University Press,p.72-91
103. Loike, J. D., & Fischbach, R. L. (2013). Ethical challenges in biodefense and bioterrorism. *J Bioterror Biodef*, 12, 2.
104. Mair, J. S., & Mair, M. (2006). *Highlights & Happenings. Biosecurity and bioterrorism: biodefense strategy, practice, and science*, 4(4), 325-343.

105. Miller, S., & Selgelid, M. J. (2007). Ethical and philosophical consideration of the dual-use dilemma in the biological sciences. *Science and Engineering Ethics*, 13(4), 523-580.

106. Millet, P.D. (2006). The Biological and Toxin Weapons Convention in context: from monolith to keystone. *Disarmament Forum*, 3:47-63.

107. Millett, P. (2010). The Biological Weapons Convention: Securing biology in the twenty-first century. *Journal of Conflict & Security Law*, 15(1), 25-43.

108. Ministry of Defence USA-Headquarters Dept. of the Army. (1994). *Planning for Health Service Support*. In: Medical Intelligence, Publication FM 8-55

109. Minogue, T. D., Koehler, J. W., Stefan, C. P., & Conrad, T. A. (2019). Next-generation sequencing for biodefense: biothreat detection, forensics, and the clinic. *Clinical Chemistry*, 65(3), 383-392.

110. Moore, J. N. (1972). Ratification of the Geneva Protocol on Gas and Bacteriological Warfare: A Legal and Political Analysis. *Va. L. Rev.*, *58*, 419.

111. Naik, S., & Ramanathan, A. (2022). The New Bioweapons Peril: A case to revisit the Biological Weapons Convention. *Indian Public Policy Review*, 3(1 (Jan-Feb)), 59-76.

112. Natarajan, N. (2007). *National imperative to establish a domestic medical intelligence center.* Naval Postgraduate School Monterey CA (Meyer) Inst of Systems Engineering. Master thesis.

113. National Research Council. (2011). *Challenges and opportunities for education about dual use issues in the life sciences.* National Academies Press

114. National Research Council. (2012). *Life sciences and related fields: Trends relevant to the biological weapons convention.*

115. NATO. (2011). *Allied Joint Medical Support Doctrine*. AJP-4.10(A), NSA(MED)0562

116. Nayan, R., Nayan, R., & Ghosh. (2019). *Global Strategic Trade Management*. Springer India.

117. Parrino, J., & Graham, B. S. (2006). Smallpox vaccines: Past, present, and future. *Journal of Allergy and Clinical Immunology*, *118*(6), 1320-1326.

118. Pearson, G. S. (1997). A Strengthened Biological Weapons Convention is Essential, Feasible and Achievable. *UNIDIR Newsletter*, p.65–75. Geneva: UNIDIR

119. Pearson, G. S. (2000). *The essentials of biological threat assessment. Biological Warfare: Modern Offense and Defense*, 55-83.

120. Pesik, N., Keim, M. E., & Iserson, K. V. (2001). Terrorism and the ethics of emergency medical care. *Annals of Emergency Medicine*, 37(6), 642-646.

121. Petro, J. B. (2004). *Intelligence support to the life science community: Mitigating threats from bioterrorism.* Central Intelligence Agency. Washington DC. Studies in Intelligence, 48(3): 57-68

122. Podbregar, I., & Ivanuša, T. (2011). Contemporary consideration and national security system reengineering. *Economics and Management*, 3, 53-56.

123. Poli, L. (2022). *Chemical and Biological Weapons' Disarmament. In International Law and Chemical, Biological, Radio-Nuclear (CBRN) Events* (pp. 396-416). Brill Nijhoff.

124. Primmerman, C. A. (2000). *Detection of biological agents*. Lincoln laboratory journal, 12(1), 3-32.

125. Raičević, N. (2010). Забрана биолошког оружја у међународном хуманитарном праву. *Зборник радова Правног факултета у Нишу*, 56 (5): 115-133. (In Serbian)

126. Revill, J., & Dando, M. (2009). *The rise of biosecurity in international arms control.* In Biosecurity (pp. 41-59). Palgrave Macmillan, London.

127. Revill, J., Borrie, J., Saunders, E., & Lennane, R. (2021). *Preparing for Success at the Ninth Biological and Toxin Weapons Convention Review Conference* | UNIDIR. Available online at: https://www.unidir.org/publication/preparing-success-ninth-biological-and-toxin-weapons-convention-reviewconference Accessed: May, 9, 2022

128. Ristanovic, E. (2009). *Bioterrorism—risk and threat: The misuse of science*. In Counteraction to Chemical and Biological Terrorism in East European Countries (pp. 121-125). Springer, Dordrecht.

129. Ristanovic, E. (2015a). *Bioterrorism: prevention and response*. University of Defence/Odbrana Media Center, Belgrade ISBN, 978-86.

130. Ristanovic, E (2016). *Bioterrorism: an old challenge in the new security architecture of modern world*. Политика националне безбедности, 233-259. (in Serbian)

131. Ristanovic, E. (2018). *Ethical aspects of bioterrorism and biodefence.* In Defence Against Bioterrorism (pp. 255-270). Springer, Dordrecht.

132. Ristanović, E. (2015b). Infectious agents as a security challenge: Experience of typhus, variola and tularemia outbreaks in Serbia. *Bezbednost, Beograd, 57*(2), 5-20.

133. Ristanović, E. S., Kokoškov, N. S., Crozier, I., Kuhn, J. H., & Gligić, A. S. (2020). A forgotten episode of Marburg virus disease: Belgrade, Yugoslavia, 1967. *Microbiology and Molecular Biology Reviews*, 84(2), e00095-19.

134. Ristanovic, E., & Jevtic, M. (2010). Dual-Use Goods in the Production of Biological Weapons. *Journal of Medical Chemical, Biological & Radiological Defense*, 8(2):304-309

135. Ristanović, E., & Zejak, S. (2020). Health and Security aspects of COVID-19 in the prism of real time. *Security Crises in the 21 st Century and How to Manage Them COVID-19 Health and safety aspects*, Volume 2, 10-22.

136. Ristanović, E., Gligić, A., Atanasievska, S., Protić-Đokić, V., Jovanović, D., & Radunović, M. (2016). Smallpox as an actual biothreat: lessons learned from its outbreak in ex-Yugoslavia in 1972. *Annali Dell Istituto Superiore di Sanita*, 52(4), 587-597.

137. Ristić, Ž. (2016). *Objedinjavanje kvantitativnih i kvalitativnih istraživanja*. Beograd: Univerzitet za mir Ujedinjenih nacija.(In Serbian)

138. Ristić, Ž., & Balaban, N. (2006). Performance evaluation and measurement of the organization in strategic analysis and control: methodological aspects. *Management Information Systems*, 1, 37-44.

139. Robert, S. D. (2004). *The Importance of Open Source Intelligence to Military*. In: Loch K. Johnson, Wirtz J. James: Strategic Intelligence-Windows Into a Secret World. Roxbury Publish Company, 112-126

140. Robertson, A. G., & Robertson, L. J. (1995). From asps to allegations: biological warfare in history. *Military Medicine*, 160(8), 369-373.

141. Rode, A., Podbregar, I., & Ivanuša, T. (2010). Military intelligence and active defence against chemical, biological, radiological, and nuclear/explosives terrorism. *Policing in Central and Eastern Europe–Social Control of Unconventional Deviance*, 487-498.

142. Romanov, V. A. (1997). The humanitarian dimension of the Convention on "silent weapons". *International Review of the Red Cross* (1961-1997), 37(318), 283-293.

143. Rosengard, A. M., Liu, Y., Nie, Z., & Jimenez, R. (2002). Variola virus immune evasion design: expression of a highly efficient inhibitor of human complement. *Proceedings of the National Academy of Sciences*, 99(13), 8808-8813.

144. Rossow, H., Kinnunen, P. M., & Nikkari, S. (2012). Botulinum toxin as a biological weapon. *Duodecim; Laaketieteellinen Aikakauskirja*, *128*(16), 1678-1684.

145. Russian Federation and UK (2018). *Core Elements for an Effective Article VII Response.* Available online at:

https://undocs.org/BWC/MSP/2018/WP.6 Accessed: May, 8, 2022

146. Ryan, J. (2016). *Biosecurity and bioterrorism: containing and preventing biological threats.* Butterworth-Heinemann.

147. Ryan, R.J. & Glamur, F.J. (2008). *Biosecurity & Bioterrorism-containing and Preventing Biological Threats.* Elselvier.

148. Salerno, R. M., Gaudioso, J., Frerichs, R. L., & Estes, D. (2004). A BW risk assessment: Historical and technical perspectives. *The Nonproliferation Review*, 11(3), 25-55.

149. Selgedid, M. J. (2007). A tale of two studies: ethics, bioterrorism, and the censorship of science. *Hastings Center Report*, 37(3), 35-43.

150. Selgelid, M. J. (2009). Governance of dual-use research: an ethical dilemma. *Bulletin of the World Health Organization*, 87, 720-723.

151. Selgelid, M. J. (2010). *Ethics engagement of the dual-use dilemma: Progress and potential*. Education and ethics in the life sciences: Strengthening the prohibition of biological weapons, 23-34.

152. Shang, L., Novossiolova, T., Crowley, M., Edwards, B., Whitby, S., & Dando, M. (2021). *Biological and chemical security after COVID-19: options for strengthening the chemical and biological weapons disarmament and non-proliferation regimes*.

153. Sims, N. A., & Littlewood, J. (2011). Ambitious incrementalism: Enhancing BWC implementation in the absence of a verification protocol. *The Nonproliferation Review*, 18(3), 499-511.

154. Sims, N.R A., & Sims, N. (2001). The evolution of biological disarmament (No.19). *SIPRI Chemical & Biological Warfare Studies*, No. 19.

155. Stan, A., & Perkins, D. (2013). United Nations Security Council Resolution 1540: a military perspective. *Strategic Impact*, *48*(3).

156. Steinberger, R., Fuart, F., van der Goot, E., Best, C., von Etter, P., & Yangarber, R. (2008). *Text mining from the web for medical intelligence*. In Mining massive data sets for security (pp. 295-310). IOS Press.

157. Stern, J. (2002). Dreaded risks and the control of biological weapons. *International Security*, 27(3), 89-123.

158. Surlova, R. (2022). Biological weapons as a tool of terrorists-bioterrorism. *Student's Social Science Journal*, 13(13), 28-38.

159. Szalados, J. E. (2012). Triaging the fittest: practical wisdom versus logical calculus?. *Critical Care Medicine*, 40(2), 697-698.

160. Tamada, D., & Achilleas, P. (Eds.). (2017). *Theory and practice of export control: balancing international security and international economic relations*. Singapore: Springer.

161. Tucker, J. B. (2000). *Biological weapons proliferation concerns*. In Verification of the Biological and Toxin Weapons Convention (pp. 33-76). Springer, Dordrecht.

162. Tucker, J. B. (2004). The BWC new process: a preliminary assessment. *The Nonproliferation Review*, 11(1), 26-39.

163. Verification Research, Training and Information Centre (2016). *Report on national implementing legislation*. VERTIC, London.

164. Walker, J. R. (2016). *Britain and Disarmament: The UK and Nuclear, Biological and Chemical Weapons Arms Control and Programmes 1956-1975*. Routledge.

165. Walsh, P. F. (2018). *Intelligence, biosecurity and bioterrorism*. Springer.

166. Ward, K. D. (2004). The BWC protocol mandate for failure. *The Nonproliferation Review*, 11(2), 183-199.

167. Warren, C.F.&Maxfield, M. (1996). *Intelligence Implications of Disease*. CIA Historical Review Program.

168. Wheelis, M. (2002). Biological warfare at the 1346 siege of Caffa. *Emerging Infectious Diseases*, 8(9), 971-975.

169. Wheelis, M. (2006). *Deadly cultures: biological weapons since 1945*. Harvard University Press.

170. World Health Organization. (1970). *Health aspects of chemical and biological weapons: report of a WHO group of consultants.*

171. World Health Organization. (2003). *Laboratory biosafety manual*, (revised).

172. WHO Ebola Response Team. (2016). After Ebola in West Africa-unpredictable risks, preventable epidemics. *New England Journal of Medicine*, *375*(6), 587-596.

173. Wissinger, J. (2015). The BWC gray area: Locating the blurry line of defining biological weapons. *Journal of Biosecurity, Biosafety, and Biodefense Law*, 6(1), 1-21.

174. Wolf, A. (1996). *Global Threats: The Role of Intelligence in the Health and Humanitarian Crises.* In: Snyder D. WWS 401: Intelligence Reform in the post-Cold War Era, Federation of American Scientists (FAS).

175. World Bank. (2012). *People, pathogens and our planet: the economics of one health*. Washington.

176. World Medical Association. (2013). World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA*, 310(20), 2191-2194.

177. Wright, S. (2006). Terrorists and biological weapons: Forging the linkage in the Clinton administration. *Politics and the Life Sciences*, *25*(1-2), 56-115.

178. Wrigley, B. J., Salmon, C. T., & Park, H. S. (2003). Crisis management planning and the threat of bioterrorism. *Public Relations Review*, *29*(3), 281-290.

179. Yadav, P. K. (2022). Evolving Dimension of Security: Bioterrorism. *Unity Journal*, 3(01), 266-277.

180. Yakovchits, N. V., Adelshin, R. V., Zarva, I. D., Chupin, S. A., Melnikova, O. V., Andaev, E. I., ... & Botvinkin, A. D. (2021). Fox rabies outbreaks in the republic of Buryatia: Connections with neighboring areas of Russia, Mongolia and China. *Transboundary and Emerging Diseases*, *68*(2), 427-434.

181. Yeh, K. B., Parekh, F. K., Tabynov, K., Tabynov, K., Hewson, R., Fair, J. M., ... & Hay, J. (2021). Operationalizing cooperative research for infectious disease surveillance: lessons learned and ways forward. *Frontiers in Public Health*, *9*, 659695.

182. Zanders, J. P., & Smithson, A. E. (2011). Ensuring the future of the biological weapons convention. *The Nonproliferation Review*, 18(3), 479-487.

183. Zhao, F., He, Y., & Lu, H. (2022). Marburg virus disease: A deadly rare virus is coming. *BioScience Trends*.

184. Zilinskas, R. A. (1992). Confronting biological threats to international security: A biological hazards early warning program. *Annals of the New York Academy of Sciences*, 666(1), 146-176.

185. Давинић, П. (1975). Међународноправни значај Конвенције о регулисању биолошких средстава ратовања, *Југословенска ревија за међународно право*. 3:271. (In Serbian)

186. Данельян, А. А., & Гуляева, Е. Е. (2022). Проблемы биобезопасности в современном международном праве. *Московский журнал международного права*, (2), 66-84. (In Russian)

187. Козин, В. П. (2016). Проблема создания на Ближнем Востоке зоны, свободной от оружия массового уничтожения: анализ современного развития и перспективы решения. *Проблемы национальной стратегии*, 3(36): 105-122. (In Russian)

188. Томилин, Ю.(1984). Обструкция Вашинготна к вопросе запрещения химического оружия, *Международная жизнь*, 8;107.(In Russian)

189. https://eng.mil.ru/en/special_operation/news/more.htm?id=12414584@egNews. Available on March 24th, 2022. Accessed: March, 25, 2022

190. https://eng.mil.ru/en/special_operation/news/more.htm?id=12417369@egNews Available on April, 14th, 2022 Accessed: April, 15, 2022

191. https://english.news.cn/20220309/f9f1679037754d28b365b0901c077fd0/c.html China urges U.S.to release details of bio-labs in

Ukraine.Source: Xinhua, Available on 9 March, 2022. Accessed: March, 10, 2022

192. https://foreignpolicy.com/2022/03/02/ukraine-biolabs-conspiracy-theory-qanon/ Accessed: March, 5, 2022

193. https://petition.president.gov.ua/petition/126550 Accessed: March, 30, 2022

194. https://press.un.org/en/2022/sc14827.doc.htm United Nations Not Aware of Any Biological Weapons Programmes, Disarmament Chief Affirms as Security Council Meets to Address Related Concerns in Ukraine, Available on 11 March, 2022 Accessed: March, 13, 2022

195. https://www.reuters.com/world/europe/exclusive-who-says-it-advised-ukraine-destroy-pathogens-health-labs-prevent-2022-03-11/ Accessed: March, 11, 2022

APPENDIX 1:

Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare. Geneva, 17 June 1925.

PROTOCOL

The undersigned Plenipotentiaries, in the name of their respective Governments:

(Here follow the names of Plenipotentiaries)

Whereas the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids materials or devices, has been justly condemned by the general opinion of the civilized world; and

Whereas the prohibition of such use has been declared in Treaties to which the majority of Powers of the world are Parties; and

To the end that this prohibition shall be universally accepted as a part of International Law, binding alike the conscience and the practice of nations;

Declare:

That the High Contracting Parties, so far as they are not already Parties to Treaties prohibiting such use, accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration.

The High Contracting Parties will exert every effort to induce other States to accede to the present Protocol. Such accession will be notified to the Government of the French Republic, and by the latter to all Signatory and Acceding Powers, and will take effect on the date of the notification by the Government of the French Republic.

The present Protocol of which the French and English texts are both authentic, shall be ratified as soon as possible. It shall bear today's date.

The ratifications of the present Protocol shall be addressed to the Government of the French Republic, which will at once notify the deposit of such ratification to each of the Signatory and Acceding Powers.

The instruments of ratification and accession to the present Protocol will remain deposited in the archives of the Government of the French Republic.

The present Protocol will come into force for each Signatory Power as from the date of deposit of its ratification, and, from that moment, each Power will be bound as regards other Powers which have already deposited their ratifications.

In witness where of the Plenipotentiaries have signed the present Protocol.

Done at Geneva in a single copy, the seventeenth day of June, One Thousand Nine Hundred and Twenty-Five.

*NOTE 1: *The Protocol have been accessed by 146 state parties.*

*NOTE 2: "*The earlier treaties prohibiting the use of gases to which the protocol refers are in particular the Hague Declaration concerning asphyxiating gases of 29 July 1899 and the Treaty of Versailles of 28 June 1919 as well as the other peace treaties of 1919. Article 171 of the Treaty of Versailles provides: "The use of asphyxiating, poisonous or other gases and all analogous liquids, materials or devices being prohibited, their manufacture and importation are strictly forbidden in Germany." See also Article 5 of the Treaty of Washington of 6 February 1922 and the note introducing the Hague Declaration (IV,2) of 1899. The United Nations General Assembly has adopted several resolutions in which it calls for strict observance by all states of the principles and objectives of the Geneva Protocol of 1925, condemns all actions contrary to those objectives and invites all states to accede to the Protocol (resolutions 2162 B (XXI) of 5 December 1966, 2454 A (XXIII) of 20 December 1968, 2603 B (XXIV) of 16 December 1969, and 2662 (XXV) of 7 December 1970). Resolution 2603 A (XXIV) of 16 December 1969 gives an interpretation of the Geneva Protocol of 1925". Source: https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/Treaty.xs*

APPENDIX 2:

Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction

(London, Moscow and Washington, 10 April 1972)

The States Parties to this Convention,

Determined to act with a view to achieving effective progress towards general and complete disarmament, including the prohibition and elimination of all types of weapons of mass destruction, and convinced that :he prohibition of the development, production and stockpiling of chemical and bacteriological (biological) weapons and their elimination, through effective measures, will facilitate the achievement of general and complete disarmament under strict and effective international control,

Recognizing the important significance of the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on 17 June 1925, and conscious also of the contribution which the said Protocol has already made, and continues to make, to mitigating the horrors of war,

Reaffirming their adherence to the principles and objectives of that Protocol and calling upon all States to comply strictly with them,

Recalling that the General Assembly of the United Nations has repeatedly condemned all actions contrary to the principles and objectives of the Geneva Protocol of 17 June 1925,

Desiring to contribute to the strengthening of confidence between peoples and the general improvement of the international atmosphere,

Desiring also to contribute to the realization of the purposes and principles of the Charter of the United Nations,

Convinced of the importance and urgency of eliminating from the arsenals of States, through effective measures, such dangerous weapons of mass destruction as those using chemical or bacteriological (biological) agents,

Recognizing that an agreement on the prohibition of bacteriological (biological) and toxin weapons represents a first possible step towards the achievement of agreement on effective measures also for the prohibition of the development, production and stockpiling of chemical weapons, and determined to continue negotiations to that end,

Determined, for the sake of all mankind, to exclude completely the possibility of bacteriological (biological) agents and toxins being used as weapons,

Convinced that such use would be repugnant to the conscience of mankind and that no effort should be spared to minimize this risk,

Have agreed as follows:

ARTICLE I

Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:

(1) microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

(2) weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

ARTICLE II

Each State Party to this Convention undertakes to destroy, or to divert to peaceful purposes, as soon as possible but not later than nine months after the entry into force of the Convention, all agents, toxins, weapons, equipment and means of delivery specified in Article I of the Convention, which are in its possession or under its jurisdiction or control. In implementing the provisions of this Article all necessary safety precautions shall be observed to protect populations and the environment.

ARTICLE III

Each State Party to this Convention undertakes not to transfer to any recipient whatsoever, directly or indirectly, and not in any way to assist, encourage, or induce any State, group of States or international organizations to manufacture or otherwise acquire any of the agents, toxins, weapons, equipment or means of delivery specified in Article I of the Convention.

ARTICLE IV

Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition or retention of the agents, toxins, weapons, equipment and means of delivery specified in Article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.

ARTICLE V

The States Parties to this Convention undertake to consult one another and to co-operate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention. Consultation and co-operation pursuant to this Article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

ARTICLE VI

(1) Any State Party to this Convention which finds that any other State Party is acting in breach of obligations deriving from the provisions of the Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council.

(2) Each State Party to this Convention undertakes to cooperate in carrying out any investigation which the Security Council may initiate, in

accordance with the provisions of the Charter of the United Nations, on the basis of the complaint received by the Council. The Security Council shall inform the States Parties to the Convention of the results of the investigation.

ARTICLE VII

Each State Party to this Convention undertakes to provide or support assistance, in accordance with the United Nations Charter, to any Party to the Convention which so requests, if the Security Council decides that such Party has been exposed to danger as a result of violation of the Convention.

ARTICLE VIII

Nothing in this Convention shall be interpreted as in any way limiting or detracting from the obligations assumed by any State under the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on 17 June 1925.

ARTICLE IX

Each State Party to this Convention affirms the recognized objective of effective prohibition of chemical weapons and, to this end, undertakes to continue negotiations in good faith with a view to reaching early agreement on effective measures for the prohibition of their development, production and stockpiling and for their destruction, and on appropriate measures concerning equipment and means of delivery specifically designed for the production or use of chemical agents for weapons purposes.

ARTICLE X

(1) The States Parties to this Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also co-operate in contributing individually or together

with other States or international organizations to the further development and application of scientific discoveries in the field of bacteriology (biology) for the prevention of disease, or for other peaceful purposes.

(2) This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international co-operation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) agents and toxins and equipment for the processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of the Convention.

ARTICLE XI

Any State Party may propose amendments to this Convention, Amendments shall enter into force for each State Party accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party on the date of acceptance by it.

ARTICLE XII

Five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Depositary Governments, a conference of States Parties to the Convention shall be held at Geneva, Switzerland, to review the operation of the Convention, with a view to assuring that the purposes of the preamble and the provisions of the Convention, including the provisions concerning negotiations on chemical weapons, are being realized. Such review shall take into account any new scientific and technological developments relevant to the Convention.

ARTICLE XIII

(1) This Convention shall be of unlimited duration,

(2) Each State Party to this Convention shall in exercising its national sovereignty have the right to withdraw from the Convention if it decides that

extraordinary events, related to the subject matter of the Convention, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other States Parties to the Convention and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

ARTICLE XIV

(1) This Convention shall be open to all States for signature. Any State which does not sign the Convention before its entry into force in accordance with paragraph 3 of this Article may accede to it at any time.

(2) This Convention shall be subject to ratification by signatory States, Instruments of ratification and instruments of accession shall be deposited with the Governments of the United Kingdom of Great Britain and Northern Ireland, the Union of Soviet Socialist Republics and the United States of America, which are hereby designated the Depositary Governments.

(3) This Convention shall enter into force after the deposit of instruments of ratification by twenty-two Governments, including the Governments designated as Depositaries of the Convention.

(4) For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

(5) The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession and the date of the entry into force of this Convention, and of the receipt of other notices. (6) This Convention shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

ARTICLE XV

This Convention, the English, Russian, French, Spanish and Chinese texts of which are equally authentic, shall be deposited in the archives of the

Depositary Governments. Duly certified copies of the Convention shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

*__NOTE 1:__ On the day of the BWC's entry into force, 26th March, 1975, ceremonies were held in London, Moscow and Washington, DC. At the London ceremony, Minister of State for Foreign and Commonwealth Affairs, David Ennals, said:

"The Biological Weapons Convention is significant as the first measure, reached since the Second World War, involving the destruction of existing weapons. Biological warfare was potentially a most frightening method of armed conflict. From today over 40 states are parties to this Convention, and have both renounced this entire class of weapons and undertaken to prevent their future development, by appropriate national measures. All governments for whom this Treaty formally enters into force today should gain satisfaction from having taken a step which will reduce the possibility of biological weapons being used in some future conflict." Source: https://www.un.org/disarmament/biological-weapons/about/history/

*__NOTE 2:__ The Biological Weapons Convention currently has 184 States Parties and four Signatory States (deposit of instrument of ratification still required-Egypt, Haiti, Somalia, Syrian Arabic Republic). There are nine States which have neither signed nor acceded to the Convention (Chad, Comoros, Djibouti, Eritrea, Israel, Kiribati, Micronesia, South Sudan, Tuvalu).

__*NOTE 3:__ Similar to many other international instruments and organizations, the States Parties to the Biological Weapons Convention have organized themselves into three groups to facilitate their preparations and discussions. The groups include the Eastern European Group (EEG), the Group of the Non-Aligned Movement and Other States (NAM), and the Western Group (WG).

The membership of these groups differs from those found in other forums, despite the similar names. For example, the Western Group of the BWC has a different membership from the Western European and Others Group (WEOG) of the General Assembly, and the group of NAM and Other States in the BWC includes China, which is not a member of the Non-Aligned Movement or similar groups in other forums. Each group has a coordinator who speaks on behalf of the group and is responsible for organizing and chairing the meetings of that group.

Source: https://www.un.org/disarmament/biological-weapons/about/membership-and-regional-groups