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ΔΙΠΛΩΜΑΤΙΚΗ ΕΡΓΑΣΙΑ

"Bioterrorism: assessing & mitigating the risk"

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Εγώ, η Καΐρη Ελευθερία, βεβαιώνω ότι το έργο που εκπονήθηκε και παρουσιάζεται στην υποβαλλόμενη διπλωματική εργασία είναι αποκλειστικά ατομικό δικό μου. Όποιες πληροφορίες και υλικό που περιέχονται έχουν αντληθεί από άλλες πηγές, έχουν καταλλήλως αναφερθεί στην παρούσα διπλωματική εργασία. Επιπλέον τελώ εν γνώσει ότι σε περίπτωση διαπίστωσης ότι δεν συντρέχουν όσα βεβαιώνονται από μέρους μου, μου αφαιρείται ανά πάσα στιγμή αμέσως ο τίτλος.

Αθήνα, 31 Μαΐου 2018

Καΐρη Ελευθερία

This one goes out to…

…all the professors of the Department, who nourished my endless curiosity and prompted me to read, question, research and propose solutions, allowing me to add my own contribution to the science of International Relations.

…my supervisor, Mr. Athanasios Platias, who gave me the creative freedom to write something original and useful for in the context of an ever-shifting and terrifying world.

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…all those, who chose to stand by my side during the days that stretched into nights and the nights that turned into days, when the bright morning Sun found me before my laptop writing furiously and wishing for it to end; the same people that pushed me to carry on, at a time when I though progress to be an impossible and painful task.

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1 Introduction

The objective of the current thesis will be to address the threat of bioterrorism, which essentially is the use of biological weapons by a violent non-state actor, AKA a terrorist group.

The academic community is at odds with the political elite in assessing the risk of biothreat. The academic community relies on empirical data, or lack thereof, to classify the threat as “low risk” but “high impact”, meaning that it is considered unlikely to happen, but if it does happen the consequences will be disastrous and far-reaching. That is not the case with policy-makers all over the world, who in the past year have augmented spending earmarked for the fight against the proliferation of weapons of mass destruction (WMD), which include biological weapons, and civil protection.

This difference of opinions stems from the responsibility to protect the public. Governments cannot simply ignore the risk of biological terrorism, because it ranks low on probability. The odds of a terror attack coming from the skies were also astronomically high, but three civilian aircrafts were hijacked and kickstarted the “War on Terror”, which continues to this day.

In a shifting and uncertain volatile environment, where the enemy is fighting with an ever-changing and evolving arsenal, decision-makers simply do not have the luxury to ignore threats to national and international security.

This thesis attempts to support the idea that the risk is real and present, looming over unprepared societies, which may be hit without prior notice by something far more deadly and terrifying than anything in a conventional arsenal.

The first part will attempt to explain the science behind biological weapons: what kind of technical know-how is required and what kind of equipment is needed to succeed in the creation of such weapons.

The second part will present the historical aspect of state-run biological programs from the earliest recorded uses all the way to the 21st century.

The third part will assess the risk of a terrorist organization acquiring weaponized pathogens, examining both previous incidents and theories developed on the matter.

The fourth part, will address all the systemic vulnerabilities that were identified throughout the thesis, by laying out a detailed policy proposal that covers the national emergency response system, all efforts by the international community to deal effectively –to a certain extent- with the issue, along with the fundamental 1972 Convention, and intelligence services.

2 Biological weapons: the poor man's atomic bomb

As Tucker (1993) states "*biological warfare agents are living micro-organisms (e.g. bacteria, rickettsiae, viruses, or fungi) that infect a human, animal, or plant host to case a debilitating or fatal illness*". They are highly potent as weapons because they self-multiply inside a host, without the users interference. Therefore, biological warfare is "*public health in reverse*", because it involves the deliberate use of pathogens or naturally occurring toxins for the purpose of killing or incapacitating (OTA 1993).

Biological agents can be classified into two categories: microbial pathogens, that are living organisms and need certain conditions to multiply, and toxins, which are non-living poisons manufactured by biological organisms and as a general rule act more quickly (OTA 1993) (Tucker 1993). Dando (2005) elaborates on the classification of biological agents which are "*best regarded as part of a biochemical threat spectrum that ranges from so-called classical (lethal) chemical weapons through poisonous industrial chemicals and mid-range agents such as toxins and bioregulators to traditional biological agents and genetically modified agents*".

In the 1990s, the Center for Disease Control (CDC) of the United States of America was asked to review the most dangerous threats to civilian populations (Rotz et al. 2002). Four criteria were used:

- public health impact: infectivity and mortality rates
- dissemination potential: stability of the agent allowing for production and delivery, potential for person-to-person transmission
- public perception: public fear and potential civil disruption
- special preparation

Using these criteria a list with three categories was compiled:

- Category A, which includes agents such as smallpox, anthrax, pneumonic plague, botulism and tularemia, is deemed the most dangerous
- Category B, which includes agents such as Q Fever, brucellosis, glanders, melioidosis, psittacosis, ricin toxin, typhus, cholera and shigellosis is less dangerous, but presents, nevertheless a significant risk
- Category C, which involves emerging threats (Rotz et al. 2002).

Biological weapons have been called “mass-casualty weapons” because they leave infrastructure intact and only claim human lives (Tucker 1999) and the “poor man’s atomic bomb” (OTA 1993), causing maximum fatalities but minimum destruction.

Their devastation is highlighted by the fact that throughout history, the accidental spread of infectious diseases caused more casualties than actual combat (OTA 1993). Nevertheless, they are considered to be poor battlefield weapons because they act slowly, as they have an incubation period ranging anywhere from 24 hours to 6 weeks, they depend greatly on external and unpredictable factors such as weather conditions, and they are impossible to control (OTA 1993). There are, though, certain situations which are optimal for bioweapons use, where the exposure to friendly forces will be minimal. The following scenarios allow for the usage of biological agents:

- Clandestine sabotage actions carried out both by non-state actors such as terrorist groups and intelligence agencies
- Attrition war, during which the delay of the incubation period would not be considered an inhibiting factor
- Special operations against key military targets deep behind the enemy line
- Attacks against large naval vessels, where the fallout will be contained inside the vessel
- Strategic attacks against large population centers or against livestock and crops in order to cut food supplies and plunge the enemy side into economic hardship and political instability (Tucker 1993)
- Deterrence (Biological weapons: New threats or old news? 1996)

The use of biological weapons can be considered as part of an “asymmetric” strategy, aiming to equalize the field between superior and inferior forces, as all technological and conventional advantages are rendered technically not important.

Zanders (1999) makes an important distinction between “biological materials” and “biological weapons”. The use of biological materials refers to the “*the use of any toxic substance or pathogen in pursuit of certain goals*”, whereas biological weapons typically include the usage of warfare agents, i.e. “*a toxic chemical designed, developed, and selected by the military to support certain missions laid out in the military doctrine of a state*”.

2.1 How to acquire bioweapons capability

Having established the strategic importance of bioweapons, it is of paramount importance to understand the science behind them. The process of acquiring bioweapons capability itself, involves three steps: research, development and weaponization (OTA 1993).

First and foremost, the proliferant state must set up one or more facilities, with specialized personnel and retrofitted security measures that will allow the research, production and stockpiling of the biohazard, along with measures that will facilitate safe disposal of biohazardous material. Such measures are needed so as to protect the workers of the facility, but also the surrounding population. If safety is not heeded properly, a deadly strain may escape and cause an epidemic in the country that produces the biological weapons, in an ironic twist of fate.

Generally, laboratories are categorized according to their biosafety levels, with level 4 being the highest. Common measures include vaccination, protective gear, negative pressure rooms in which air flows into the room but does not escape, high efficiency air filters and the incineration of exhaust. There are commercially available containment systems, used by many pharmaceutical plants for the development of antibiotics and other drugs, which are equal to a designated level 4 facility (OTA 1993).

After having established security protocols, an agent must be chosen. Just because a pathogen can cause a severe disease, it does not necessarily mean that it is a potential warfare agent. Of the several hundred pathogens, only 30 are considered as likely agents for biowarfare, throughout history. Dando (2005) compiles a list of nine desirable characteristics:

1. An agent should produce a certain effect consistently
2. The dose needed to produce the effect should be low
3. The incubation period should be short and predictable
4. The target population should have little or no immunity
5. Treatment for the disease should not be available to the target population
6. The user should have the means to protect troops and civilians
7. Mass production of the agent should be possible
8. Effective dissemination of the agent should be possible
9. The agent should be stable in storage and transportation in munitions

Apart from these 9 characteristics, three additional issues must be considered: virulence, infectivity and ability to withstand environmental stress.

The first characteristic highlights consistency but high virulence should also be considered. In other words, the agent must cause incapacitation or death without "*experiencing an undue loss of potency during production, storage and transport*" (OTA 1993).

Secondly, infectivity must also be taken under deliberation: on one hand an agent that remains highly contagious after first use is particularly attractive (Dando 2005), but on the other hand a high rate of infectivity could risk triggering an uncontrollable pandemic that will affect the user's population as well (OTA 1993). Furthermore, an uncontrollably high rate of infectivity coupled with a high rate of fatality could kill all hosts resulting in the disease burning out faster than anticipated.

Finally, the agent in question must be able to survive environmental stress such as temperature fluctuation, light and desiccation (OTA 1993) along with the sheer force of the explosion of the weapons that will deliver the agent (Zanders 1999).

Nowadays, it is very easy to acquire the pathogens themselves as they can be found in nature (soil, infected livestock or wild animals, spoiled food) or readily available in the market, as there are commercial biological supply houses, which culture thousands of microbial strains for legitimate biomedical research (Tucker 1993) (OTA 1993). However, it must be noted that most pathogens that are produced commercially have almost no military utility, while those that do are heavily regulated and produced in specific amounts in a handful of government facilities (OTA 1993).

Most biological programs involve agents already researched in the past, and as such aspiring countries prefer already weaponized pathogens due to the lack of sophisticated technology (OTA 1993) that would facilitate research into new emerging threats and the lack of resources that would allow the import of such technology and specialized personnel.

Once the research facility is set up and the biological agent is acquired, the proliferant state will look into ways to enhance the desired characteristics of the agent through simple selection techniques, thereby choosing the most resistant strains. Further genetic engineering might include incubating the agents in the presence of standard antibiotics in order to increase resistance to antibiotics (OTA 1993).

One of the most ominous sides of technological advancement is without a doubt the progress in the field of genetic engineering. As the name implies, scientists are able to manipulate segments of DNA of any living organism. The implications are terrifying as through genetic engineering all diseases that are deadly by nature can be made even more lethal by altering basic characteristics such as infectivity, virulence, and antibiotic resistance. However, genetic engineering can also render bioweapons more controllable, more resistant to climatic conditions and existing vaccines and antibiotics, as such increasing their military utility (OTA 1993) (Tucker 1993).

After a desirable strain has been selected, testing will begin in order to assess its military potential. Factors such as virulence, infectivity, dosage, infection course and stability must be taken under consideration, while also taking into consideration that the delivery system must be designed to allow for wide dispersion without sacrificing the agent's potency (OTA 1993).

The most important aspect of biowarfare is the ability to "weaponize" biological agents, which remains to this day, a significant obstacle. Weaponization involves the ability to integrate the biological agents into a delivery system, and therein lays the main difference between military and terrorist use. In order for the bioweapons to have attainable strategic benefits depending on the objective, the military –or the state- must be able to control and predict their effects, instead of unleashing chaos. On the contrary, terrorist organizations, for their most part, do not discriminate and often they target military personnel and civilians alike (Tucker 1993).

There is commercial equipment, which, under the right conditions, could serve as a crude delivery system such as agricultural sprayers used for the dissemination of microbial pesticides over a large area, although for a more precise hit, which would be tactically more useful, extensive research would be required (OTA 1993) .

However, there are certain technical hurdles, which could be seen as probably the only impediment to large scale usage of bioweapons. First of all, the agent must be stabilized so that it can survive the process of production, stockpiling and dissemination without sacrificing potency. The delivery system itself must be able to create an aerosolized cloud big enough to be inhaled deeply into the lungs, with the dissemination being slow to avoid losing viability or toxicity. Most important of all, the dissemination must be in a predictable pattern that will affect only the target area and will permit tracking the progress of infection (OTA 1993).

After a dissemination method has been selected, the proliferant state must scale up its production. The global expansion of civil biotechnology industry along with the growing number of trained biotechnologists allows for broader access to equipment and technical know-how, which can be found, for the most part, on published scientific articles. (OTA 1993).

Moreover, advanced fermentation techniques make shelf-life irrelevant. In the past, due to the fact that it was time-consuming to develop weaponized biological agents, many extended the shelf-life by refrigerating the agents in a process called “lyophilization”. But even then, the product could not last more than a few months. Today, though, advanced fermentation techniques allow for the development of weaponized agents within a matter of days, as such eliminating the need for stockpiling (Tucker 1993).

To further complicate the matter for policy-makers, biological weapons are considered to be relatively cheap to develop, because the technologies required are all dual-use. This basically means that the skills, materials and technology which is used for civilian purposes, can be also used for a military-grade biological weapons program (Koblentz 2010). As such, not only is the equipment easier and less expensive to acquire but it is also easier to conceal; it is almost impossible to distinguish between illegitimate and legitimate activities (Biological weapons: New threats or old news? 1996).

For instance, large scale production of biological agents necessitates metal fermenters, such as the ones used for beer and yoghurt, and owing to the technological evolution of the 21st century, this process can be completed in even smaller pilot-scale fermenters (Tucker 1993).

Especially for non-state actors, though, there might be another choice: the black market and decommissioned facilities. The dissolution of the former Soviet Union, with all of its security concerns regarding the security of numerous highly restricted facilities brought to light in the ‘90s the very real danger of proliferation (Gressang 2001). A group could easily gain access on very dangerous strains, whether they were weaponized or not, and either sell them to the highest bidder such as other organizations or even governments, or use them like any other weapon thereby eliminating most of the technical challenges.

In conclusion, what kind of equipment is needed to produce a biological weapon?

The reply is best summarized by “The Australia Group”, an informal forum of countries, which according to its website is “*an informal arrangement which aims to allow exporting or transshipping countries to minimise the risk of assisting chemical and biological weapon proliferation*”. A number of countries, parties to the 1972 Convention participate, including the European Union (1985) and Greece (1985).

In short, the list –as presented it the website (The Australia Group 2017)- is as follows:

1. Containment facilities, which meet specific criteria
2. Fixed installation equipment such as double-door pass-through decontamination autoclaves; breathing air suit decontamination showers; mechanical-seal or inflatable-seal walkthrough doors.

3. Fermenters
4. Centrifugal separators
5. Cross (tangential) flow filtration equipment capable of separation of micro-organisms, viruses, toxins or cell cultures that fulfill certain characteristics
6. Freeze and spray drying equipment
7. Protective and containment equipment such as full or half suits, biocontainment chambers, isolators, or biological safety cabinets
8. Aerosol inhalation equipment designed for aerosol challenge testing
9. Spraying or fogging systems

2.2 Genetically engineered biological agents

The past few decades, biotechnology and life sciences in general have witnessed a remarkable progress, as scientists become more and more able to synthesize life and manipulate genomes, with the added benefit of greatly reducing the cost of such an endeavor. The main issue that arises is that mankind, in its unquenchable thirst for knowledge, is focusing almost solely on its ability to create and manipulate life rather than on the measures required to prevent the misuse of such potent technology (Koblentz 2010).

Specifically, the rapid developments in biotechnology, genomics and genetics have created new concerns for international peace and security, particularly in the field of biological weapons. Apart from the most obvious threat, that of a genetically engineered "superbug" –highly resistant to antibiotics and to extreme environmental changes- the most worrisome aspect is the probability of creating an entirely new pathogen (van Aken & Hammond 2003).

Genetic engineering is the process of identifying DNA strands in a pathogen, cutting and splicing them with enzyme tools so as to create "recombinant" strains that possess the desirable characteristics. Naturally harmless microorganisms can be modified to be extremely toxic. Unstable agents that cannot be stored for a prolonged period of time can be genetically altered to withstand stockpiling and dissemination through delivery means (OTA 1993).

Advanced engineering technology is still rare in the developing world, but not only the theoretical knowledge can be found in published academic articles, there are also mail order "kits" containing the necessary equipment and reagents, that allow for experimentation from home (OTA 1993).

Compared to other types of research, such as nuclear research, though, genetics lack a past incident that would underline just how much of a threat it really is. This analogy can be demonstrated when adding Hiroshima and Nagasaki to the mix, as the public knows –even today, almost 75 years later- the destructive power of nuclear weapons. That is not the case for bioengineered pathogens. The public can only imagine the potential horrors and thus the lawmakers and policy advisors remain divided over whether or not the research itself could be used for nefarious purposes (Kay 2003).

It is believed that, through gene-splicing techniques, second generation biological agents can be created that will have more useful characteristics for military application, such as resistance to antibiotics and extreme weather phenomena, high infectivity and virulence (OTA 1993).

However, it is for the moment considered highly unlikely that an engineered pathogen would become more lethal than a naturally occurring one, for the simple reason that an agent possesses certain characteristics not solely because of the DNA strands that provide the abilities themselves, but also due to the overall traits that give rise to pathogenic behavior. As such, altering just one trait will not yield a much more deadly pathogen than natural disease agents (OTA 1993).

In most cases, though, lethality is not always the goal. Genetic biotechnology might not allow mankind to drastically alter the virulence of a pathogen, but it can contribute in overcoming certain obstacles that concern environmental stability, incubation period, resistance to antibiotics and vaccine production. For instance, throughout the stages of a basic biological weapons program, genetic intervention might be necessary only with regards to the delivery of the pathogens. In order to create efficient and adequate means of delivery, certain biological obstacles must be overcome. History shows that it is especially challenging, and so far has only been accomplished by states with large programs and sufficient funds. On the other hand, Iraq had an active program for years but never managed to surpass this particular obstacle and only developed rudimentary and crude delivery means (van Aken & Hammond 2003).

In that sense, naturally occurring pathogens have hardly any military usefulness, because they don't meet certain standards such as the ability to act or reproduce fast enough. Therefore, it becomes apparent that a very basic genomic intervention could significantly alter a pathogen's suitability. As far as resistance to antibiotics is concerned, which is arguably the most important characteristic strategically-speaking, modern laboratories and universities all over the world have the ability to introduce some level of resistance to pathogens, as such providing the basic knowledge to overcome such obstacles (van Aken & Hammond 2003).

Perhaps the most important aspect of bioengineering is the potential to replicate and manufacture strains that are considered eradicated or are highly regulated. Although it sounds like the scenario of a movie, scientists have managed to synthesize the polio virus from scratch (Cello, Paul & Wimmer 2002). Experts on the matter estimate that five other viruses can be synthesized artificially in a laboratory, among which the most important are the Ebola virus, the Marburg virus and the Venezuelan equine encephalitis virus. Particularly, the first two, are considered rare and exotic diseases and especially useful for groups or states wishing to launch a biological weapons program. In theory, the published procedure could be applied to these strains as well, as such increasing exponentially the probability of horizontal proliferation (van Aken & Hammond 2003), especially when taking into account the fact that scientists have in their hands the "*complete sequence of more than 70 major bacterial, fungal and parasitic pathogens of human, animals and plants…representing approximately 250.000 predicted coding sequences*" (Fraser & Dando 2001).

Genetically modified pathogens have an even more deadly side than their natural counterparts. While not many physicians are familiar with the symptoms of rare diseases, a simple search can rectify that and the patient would be treated as if it was any other day -probably not thinking immediately that the patient was infected on purpose as part of the attack.

On the other hand, bioengineered agents add the element of unpredictability to the equation (Colonel Ainscough 2002). Once a patient is diagnosed with anthrax inhalation, for example, the doctor will prescribe the necessary antibiotics, warn the CDC and be on the lookout for more cases. This process is only possible because biologists are intimately familiar with the physical characteristics and symptoms of anthrax inhalation. On the other side, if a patient presents with an unusual condition, the CDC will be notified to try and identify the disease. But what if the culprit is a genetically modified version of influenza, which has never been used before? The course of the disease, its incubation period, infectivity, transmission methods, strengths and weaknesses and of course its potency would be completely unknown to the world, and the public health system would be brought to its knees.

2.3 Incentives and disincentives for states

When a state is considering launching a bioweapons program it is highly important to consider potential risks and rewards. Apart from the afore-mentioned technical difficulties such as production and efficient delivery, a state must take into account its goals, considering that, once deployed, a bioweapon may not yield the desired results instantly due to the varied incubation period for each microorganism (Cameron et al. 2000), which may take even years under the right conditions (Hall et al. 2002).

Bioweapons programs are extremely attractive for states for a number of reasons. First of all, biological agents are extremely potent per kilo. On one hand, this implies that the facilities required for the successful production and stockpiling of the weaponized agents can be discreet and easy to hide, especially when taking into consideration the fact that all equipment is dual-use. On the other hand, it means that the agents themselves can be easily hidden and just as easily reproduced in case of an emergency (OTA 1993).

Moreover, another important aspect must be taken into consideration. Most biological agents do not have a 100% mortality rate, but they do temporarily incapacitate all those affected. Therefore, in the window of opportunity created, collateral damage can be easily avoided thereby increasing their tactical usefulness, all while remaining within the grey moral boundaries of society (Brigadier General Zajtchuk (ed.) 1997, p. 457).

Technologically speaking, compared to other types of weapons of mass destruction, biological weapons are easy to manufacture. The technology required is readily available on the market, as most pieces of equipment needed are dual-use and can be used for legitimate activities such as the fermentation of various beverages. Therefore, covert production is highly probable especially when taking into consideration that the know-how itself, nowadays, is easily disseminated with Universities being the main pool of qualified and skilled personnel.

Disconcertingly enough, some of the agents themselves are actually dual use. For example, botulinum toxin, one of the most commonly used pathogens in biological weapons programs, has been approved by the US Food and Drug Administration (FDA) as treatment for ocular muscle disorders, such as strabismus and blepharospasm. In that sense, potentially all pathogens, from fungi to viruses and toxins, can be dual-use in the fight against other illnesses (Brigadier General Zajtchuk (ed.) 1997, p. 457).

Furthermore, as there are no signatures distinguishing illegal activities from the permitted "peaceful" activities, other states can only rely on human intelligence (HUMINT), using workers in the laboratories or defectors as assets, as all other types of intelligence will yield nothing. HUMINT, although very useful, is unpredictable and complicated. In the 21st century, almost three decades after the end of the Cold War, states and governmental agencies are increasingly suspicious because the enemies of the new anarchic and unstable multipolar system are unknown. For this reason states safeguard such covert programs, making it virtually impossible to verify the production of biological weapons. The failure of

HUMINT became apparent during the inspections on Iraq by the United Nations Special Commission, as the individuals that provided the on-ground intelligence were unreliable or misleading, for the simple reason that they did not have complete knowledge of the Iraqi biological weapons program and they lacked the technical skills to understand what they were describing.

Much to the dismay of law makers, biological weapons are also economically sound investments, especially compared to their equally-disastrous nuclear and chemical counterparts. The start-up cost itself is not prohibiting, as is the case with nuclear weapons, as not only the producing equipment can be bought at retail, but also the pathogens are extremely potent. The same applies for delivery means. One of the most cited figures demonstrating the cost effectiveness of biological weapons belongs to Douglas and Livingstone (1987, p. 16), who mention "*A group of [chemical and biological weapons] experts, appearing before a UN panel in 1969, estimated 'for a large scale operation against a civilian population, casualties might cost about $2.000 per square kilometer with conventional weapons, $800 with nuclear weapons, $600 with nerve gas weapons, and $1 with biological weapons".*

Another important characteristic, unique to biological weapons, is the element of fear it can cause to the target state's troops. From potential deformity and disfigurement resulting from an illness, to the knowledge that for many of nature's worst pathogens there is no cure, the levels of fear and anxiety are significantly heightened, causing people to work on autopilot and becoming more likely to make mistakes (Hall et al. 2002).

However, it must be noted that one of the main functions of a biological arsenal is considered to be its deterrence capabilities, with the important distinction between non-contagious agents, such as toxins, and contagious agents, such as smallpox. This duality can prove to be both an incentive for a state to launch a biological program and a disincentive at the same time.

As far as non-contagious agents are concerned, which include ricin and anthrax, they are cheap to manufacture, especially with regards to their potency and lethality –albeit to varying degrees due to environmental conditions- and geographically limited capability as they cannot reproduce. When combined with the element of fear instilled in the heart of the people, these agents seem to be the perfect alternative to nuclear weapons: destruction without the risk of a nuclear winter (Baum 2015). However, what Baum considers to be an alternative deterrent which may push states into seeking proliferation, Edwards (2015) deems as "*naïve and misguided*" based on a "*grossly oversimplified understanding*". For him the merits of their technical advantages are overshadowed by their unpredictable nature, going back on the reason why they were prohibited in the first place. He warns of the risk of horizontal proliferation as more and more states to pursue programs kick-starting an arms race, leading to international destabilization.

Taking a look into the applicable disincentives, it is obvious that several factors which act as incentives double as disincentives. Whereas the shocking potency of bioweapons is what makes them into the most efficient weapon, there is general consensus that contagious agents are far too unpredictable and untested to be of actual use to a state without risking an extinction-level event, taking into consideration that there is no cure for many of nature's deadly pathogens.

In this vein, the same fear that is a powerful incentive for states is an extremely potent disincentive for policy-makers and, in any case, the population of the proliferant state. The volatile and uncontrollable nature of pathogens, which is dictated solely by their genetic make-up, is what terrifies civilians and military personnel alike. Humankind's most basic instincts suggest keeping as far as possible. While no one can question the destructive force of a nuclear explosion, the fallout is admittedly contained to a certain location. On the contrary, an infected person in today's interconnected and globalized world can travel to all continents before presenting with any symptoms but having infected an unimaginable number of people.

Therefore, while biological weapons are the smart choice in terms of sheer cost-effectiveness, the level of unpredictability and the instinctive fear they cause almost eliminate the possibility of a state choosing to develop a biological arsenal revolving around diseases.

To summarize, the incentives and disincentives for states are the following:

STATES	
INCENTIVES	**DISINCENTIVES**
Potency per kilo of pathogen	**Unpredictability**
Dual-use equipment for production & stockpiling	**No cure for the majority of pathogens**
Covert production	**Possibility of horizontal proliferation**
100% incapacitation and not 100% mortality	**Fear**
Detection relies on unreliable HUMINT	
Cost effective ($/per square kilometer)	
Deterring power	
Fear	

3 The first recorded uses of biological weapons

In battle most injuries and deaths are attributed to diseases and non-battle injuries, rather than the actual battle itself, that inevitably affect negatively combat capability. One of the most cited examples is the influenza epidemic that ravaged the world during World War I and killed approximately 20 million people in 1918 (Colonel Ainscough 2002).

The statistics of war were not lost on mankind, that sought to weaponize every advantage available in order to win, including diseases.

Biowarfare has been significantly evolved from using corpses to infect water supplies all the way to perfecting special ammunition for field usage. The evaluation of its history, though, hides a lot of pitfalls and needs to be examined critically, as first and foremost it is nearly impossible to verify alleged or even actual attacks, due to the extensive effects of propaganda, as well as the rarity of certain microbiological and epidemiological evidence, which further complicate things (LTC George W. Christopher et al. 1997).

In this vein, during a war, endemic and epidemic diseases are common as the normal social and economic life is disrupted, as such making the distinction between natural occurrence and human action nearly impossible (LTC George W. Christopher et al. 1997).

Finally, the finer mechanisms of infectious diseases were properly researched during the second half of the 19th century, as such making impossible the intentional use of biological agents based on scientific conclusions, that would provide some evidence of the activity (Dando 2006, p. 11).

Historians have established a set of criteria, which, once met, point with a high degree of certainty to the use of bioweapons. First and foremost, the action must make political and historical sense, meaning that it should be feasible with the technology at hand and compatible with the scientific advancement of the era. Once the historical environment is set, there must be some sort of evidence that corroborates the allegation that also allows the evaluation of the attack, or at the very least the source of the allegation must be clearly documented (Dando 2006, p. 12).

It becomes evident, however, that until the late 19th century it is very difficult to confirm with absolute certainty the use of biological weapons.

During the early stages of biowarfare, when the usefulness of transmissible diseases was first recognized, mostly human corpses and animal carcasses were used in order to infect wells, water reservoirs and other water sources. This tactic, albeit rudimentary, has been used from the dawn of human history up until today (LTC George W. Christopher et al. 1997), with evidence so far supporting that the ancient Greeks as well as the Romans and the Persians employed frequently this tactic (Poupard & Miller 1992).

One of the earliest recordings of biological warfare comes from 184 BC. Hannibal, the leader of the Carthaginians, was preparing for a naval battle with King Eumenes of Pergamum. Prior to the battle, he ordered that "*earthen pots be filled with serpents of every kind*". The pots were hurled onto the ships of the enemies, who had to fight two battles, and as a result lost (Brigadier General Zajtchuk (ed.) 1997, p. 416).

In the 14th century, during the siege of Caffa, what is today Feodosia in Ukraine, the attacking Tatar force presented with plague. They attempted to capitalize on their bad luck by launching with catapults the infected bodies of their dead so that the epidemic could affect Caffa, which was the case in the end. The defending army fled as soon as possible and surrendered. However, shortly after, ships carrying refugees made port in Constantinople, Genoa and Venice, along with other major Mediterranean ports, a second pandemic broke out (Dando 2006, p. 11), effectively demonstrating that bioweapons could have unforeseen effects.

Nevertheless, it would be considered as methodologically simplistic to assume that the biological attack on Caffa was the only reason which caused the pandemic, because the complexity of the ecology and epidemiology of the plague must be factored in, as it could have been transmitted by rats and other rodents, along with the poor hygiene conditions within the walls of the city (LTC George W. Christopher et al. 1997).

Smallpox was used as a weapon against Native Americans during the 18th century, and more specifically during the Indian-French war (1754-1767) at Fort Pitt, when the British commander suggested using the virus on purpose to reduce the native population. The plan was set in motion after an epidemic broke out at Fort Pitt, generating fomites, which are objects or materials which are likely to carry infection, such as clothes, utensils, and furniture. The colonists handed out contaminated blankets to the Indians, following the example of the Trojan Horse. The event is documented in a journal kept by one of the militia commanders as well as in a list compiled by the captain of the fort (Dando 2006, pp. 12-13). Undoubtedly, other factors contributed in spreading the disease such as direct contact between the native populace and the colonists, as the usage of fomites is by far less effective than transmission via respiratory droplets (LTC George W. Christopher et al. 1997). Therefore, it remains unclear whether the reason behind the outbreak is the actions of the British at Fort Pitt (Dando 2006, p. 13).

The last two decades of the 19th century saw a revolution in bacteriology. Although, the scientific field was still under-developed as evidenced by many theories, which posited that the reason behind infectious diseases were supernatural forces, the systematic accumulation of knowledge and better practice led to world as is known today (Poupard & Miller 1992).

4 Biological weapons in the 20th century

4.1 World War I

One of the most important efforts in the field of biological weapons belongs to Germany, which attempted to hinder the US' preparations before it officially entered the war in 1917. In an effort to sabotage the supplies sent to the Allies, from 1915 until mid-1916, Germany used biological agents, such as anthrax and glanders, to infect the horses which were being prepped for shipment in Europe. Until now it remains unclear whether the sabotage campaign was actually successful (Dando 2006, p. 17).

Germany also launched covert operations in neutral countries that were trading partners with the Allies aiming to infect livestock. For example, anthrax was used on Romanian sheep that were due for exports in Russia (LTC George W. Christopher et al. 1997). Norway and Argentina were also targeted with anthrax meant to infect the livestock. The efforts were intercepted by the British, particularly in the case of Argentina, since the operation required the transmission of messages and the import of the biological agents, but they did not consider the threat to be immediate and deemed the campaign ineffective (Dando 2006, p. 18).

In summary, the only noteworthy biological program at the time, shortly after the revolution in the field of bacteriology, belonged to Germany, but it can be safely concluded that no biological weapons were used in a large-scale battlefield during the First World War (Poupard & Miller 1992). The British did consider biological warfare but, taking into account the scientific advancement of the time, did not think that it was feasible to achieve a devastating blow to the opponent (Dando 2006, p. 18).

4.2 Interwar period

After the war ended, the international community was understandably horrified by the heinous crimes committed mostly with chemical weapons, and as a result all diplomatic efforts concentrated around combatting proliferation and usage of these mass destruction weapons. All attempts culminated in the Geneva Protocol of 1925 for the "*Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare*", which is considered to be part of the international customary law and as such is binding for all states (Dando 2006, p. 18). The Protocol per se, prohibited only the use of biological weapons but did not prohibit research, producing and stockpiling such weapons, and did not provide for inspections. Additionally, the majority of the signatory countries explicitly reserved the right for retaliation in case of a bioattack (LTC George W. Christopher et al. 1997).

The Protocol itself did not seem to deter the proliferant states of the time. For instance, evidence demonstrates that France had a very serious biological weapons program from the end of the First World War until its fall in 1940. After the rise of Adolf Hitler in power and in the general context of escalation, France was fervently against the rearmament of Germany and in numerous occasions reiterated that it would do anything in its power to ensure its security, including stepping up its efforts concerning biological warfare (Dando 2006, pp. 18-19).

Japan also conducted research on bioweapons in occupied Manchuria from 1932 until World War II. The reasoning was that all research into offensive use had to be done outside of Japan, since it required human experimentation (Dando 2006, p. 22). Unit 731, a research team focusing on biowarfare mostly delved into pathogens such as anthrax, meningococcus (*Neisseria Meningitidis*), cholera (*Vibrio Cholerae*), and the plague (*Yersinia pestis*), which were being tested on prisoners. The number of victims is estimated to have reached 10.000 either due to infection as a direct result of experimental infection or due to execution after the experiments were over, however it is impossible to have an accurate death toll due to the fact that most documents related to this research were destroyed (LTC George W. Christopher et al. 1997).

Details of the Japanese bioweapons program became known to the public after the end of the World War II, when the US decided to grant amnesty on a number of Japanese scientists on the condition of full disclosure on the matter (Brigadier General Zajtchuk (ed.) 1997, p. 427).

The Soviet Union, as a Great Power, could not remain on the sidelines of this lethal game, taking into consideration the heavy losses it suffered because of chemical weapons during World War I. The Soviet Union was quick to launch a biological weapons program shortly after the internal situation was stabilized. In early 1920s the techniques used were considered primitive and consisted of infecting whole animals: once the infected animal died, after presenting a complete clinical picture, the scientists would ground them into powder for future use (Tucker 1999). During the purges of 1930s a lot of prominent scientists were arrested and some were even charged with sabotage. Inevitably the arrests *en masse* had a significant impact, evidenced by the fact that during World War II, the Soviets mostly deployed defensive biological countermeasures such as vaccines. All reports about offensive use remain for now uncorroborated (Dando 2006, p. 25).

The United Kingdom was also involved in the matter, as in 1936 the Bacteriological Warfare Subcommittee was formed, mostly as a response to the German efforts. The UK had ratified the 1925 Protocol, but, according to the submitted reservations, it withheld the right to retaliation. In 1939 the body was transformed into the War Cabinet Committee on Biological Warfare. The main plan was supposed to be launched in case Germany ever attacked the UK using biological weapons and it included the use of anthrax spores to wipe out cattle, as such dealing an incapacitating blow on the German economy (Dando 2006, p. 26).

4.3 World War II

The start of the Second World War inaugurated the new golden era for biological weapons with highly intensive programs and remarkable scientific developments despite the politically unstable environment.

Soon after the war broke out, the Japanese started suffering heavy defeats on the Soviet–Manchurian and Manchurian–Inner-Mongolian borders by the Red Army. It was the perfect time for the Japanese biological weapons program to be put to the test with acts of sabotage and the firing of shells filled with germs. Both sides suffered heavy losses due to cholera, dysentery and plague but it is not clear whether it was because of intentional infection or the general unhealthy conditions in the battlefield (Dando 2006, p. 24).

A number of scientists, arrested by the Soviets, admitted to 12 large scale field tests in their in testimony obtained during war crimes prosecution, while at least 11 Chinese cities were attacked with bioweapons either by contaminating the aquifer, or the crops with anthrax, cholera, salmonella and the plague. However, despite the extensive research, the Japanese army was not properly prepared, and as a result during an attack in town Changteh on 1941, from the 10.000 dead approximately 1.700 were Japanese who succumbed to cholera due to inadequate information and equipment. Japan stopped conducting field tests on 1942, but the research was continued until the end of World War II (LTC George W. Christopher et al. 1997).

At the European branch of the Axis, Adolf Hitler allegedly issued orders prohibiting the research and development of bioweapons for unknown reasons. His decision was in part respected by many German commanders and members of the German scientific community (Dando 2006, pp. 24-25). Be that as it may, some scientists with the support of high-ranking members of the Nazi party carried on with the program, which was significantly inferior compared to the rest of the countries dabbling in biowarfare.

The main experiments were conducted on prisoners held in concentration camps. Nevertheless, the main purpose of the program was not to perfect a bioweapon but rather to study a plethora of pathogens in order to develop vaccines and medicine (LTC George W. Christopher et al. 1997).

According to the bibliography, Nazi Germany used only once tactical bioweapons on May 1945, when the army infected a large reservoir of water with sewage in Northwestern Bohemia (LTC George W. Christopher et al. 1997). The main issue, however, remained: in the throes of 1930s and Germany's illegal re-militarization, the Allies falsely concluded that Germany had launched an ambitious biological program (Furmanski 2006) and as such the Allies developed bioweapons so that they could be used as retaliation in case the Axis powers launched a bio attack.

The reason behind the erroneous perception was most likely the failure of HUMINT. In 1934, an anti-Nazi German émigré provided Wickham Steed –a well-respected investigative reporter- with a series of papers dated between 1931-1933 showing Germany's efforts. After Germany was reunified, however, the rest of the papers became available to the public and no evidence was found to support the claim that the Axis powers could launch a serious biological attack. The most likely explanation for this failure is the efforts of many anti-Nazi German émigrés trying to alert the world of the regime's destructive appetites (Furmanski 2006).

Without a doubt the most significant biological weapons program was developed in the United States, launched in 1942 under the direction of a civilian agency, the so called "War Reserve Service" (WRS) (Army 1977), which revolved mostly around anthrax and swine brucellosis (*Brucella Suis*), but later on, the bulk of the responsibility was transferred to the Chemical Warfare Service of the Army (later, it was designated as "Chemical Corps") although the overall supervision rested upon the WRS . The facility, though, did not have the necessary protection measures, and for this reason no large scale field tests were ordered (LTC George W. Christopher et al. 1997).

It is worth noting the doctrine on biological weapons echoed the chemical weapons doctrine, which only concerned the possibility of retaliation, excluding first-use, even though the US had not ratified the 1925 Protocol. Be that as it may, President Roosevelt –along with Prime Minister Churchill- announced this doctrine in a unilateral statement in 1942 (Army 1977).

In spite of the policy announcement, both countries continued amassing a large biological arsenal. The US mostly looked in to agents that could be used against plants, and according to records there were plans to specifically target the Japanese crops (Brigadier General Zajtchuk (ed.) 1997, p. 427). The UK retained a large stockpile of five million anthrax-laced cattle cakes, which were to be used for retaliation only. The stockpile was destroyed immediately after the end of the war, although some offensive research was still carried out until 1957 (Dando 2006, pp. 43-44).

4.4 Cold War

After the end of the Second World War, the major players of the international system such as the US, the Soviet Union, Canada and the UK, had ambitious and highly developed biological weapons programs, with France re-launching its own, which was terminated after the German invasion. However, the US program was phased down to a research status (Army 1977).

In 1946, the US War Department acknowledged for the first time the existence of the American program, with the press release emphasizing mostly safety, in order to avoid accidental infection. Additionally, it was stated that there had been 60 recorded cases of accidental exposure to a biological agent, but with no fatalities, underlining the technological progress that accompanied the program. (Brigadier General Zajtchuk (ed.) 1997, p. 427)

In 1948, the Committee on Biological Warfare was formed, whose main task was to evaluate whether or not biological weapons could be used as weapons of sabotage. The result -the Baldwin report- demonstrated that the US was particularly vulnerable to covert attacks and recommended the creation of means to detect and identify pathogens; research into methods for decontamination, prophylaxis, protection and treatment; and –most importantly- the development of means capable to disseminate the agents during special operations, such as the use of "innocuous organisms" in ventilation systems and the public water supplies (Brigadier General Zajtchuk (ed.) 1997, pp. 427-428).

The Korean War (1950-1953) rejuvenated the American program, with new modern facilities allowing storage of the microorganisms that could either be potentially weaponized or be used for developing counter measures and other defensive uses, such as vaccines, due to increased concerns over the involvement of the Soviet Union (Army 1977). However, it is worth noting that at the time the "retaliation-only" policy was reaffirmed and remained the standing military doctrine (Dando 2006, p. 36). Human experiments kicked off in 1955 on volunteers, for the purpose of verifying the vulnerability to aerosolized pathogens and the efficacy of vaccines, prophylaxis, and therapies, that were being developed (LTC George W. Christopher et al. 1997).

During the Korean War, the Soviet Union and China both accused the United States of manufacturing biological weapons (Poupard & Miller 1992). The accusations were supported by the findings of an

International Scientific Committee, as well as other organizations, which proclaimed that the investigation was objective, while in fact it was under the control of the Soviet and North Korean government (Furmanski 2006). The United States admitted to possessing bioweapons, but denied ever having deployed them and demanded a new investigation. The International Commission of the Red Cross proposed the establishment of a committee, with the intervention of the World Health Organization (WHO), but both North Korea and China refused the proposal under the pretext that implicating WHO was just an attempt at espionage from the United States. Consequently, the United Nations, along with other 15 Member-States of the United Nations submitted a draft resolution requesting the establishment of an objective committee, which would look into the allegations. The Soviet Union blocked the resolution, further deteriorating the landscape for the United States, which had not ratified the Geneva Protocol of 1925 and had openly admitted to possessing bioweapons. Its international standing and prestige was heavily damaged, as such proving just how powerful allegations for bioweapons, regardless of their veracity, are (LTC George W. Christopher et al. 1997).

In 1956 the American policy shifted. In response to Soviet statements arguing in favor of future use of chemical and biological weapons during wars for the purposes of mass destruction, "retaliation-only" was abandoned (Poupard & Miller 1992). According to the new doctrine biological –and chemical- weapons could be used to "*enhance military effectiveness*" (Dando 2006, p. 37), which is a vague enough terminology to allow anything.

A decade later, the Nixon administration, in 1969-1970, renounced unilaterally both biological and toxin weapons (Tucker 1993), ordered the bioweapons program to shut down and adopted a policy of non-usage for biological weapons under any circumstances, putting an end to research for offensive purposes. Additionally, Nixon pledged to submit the 1925 Protocol for ratification by the Senate (Dando 2006, p. 39). As a result, more funding was funneled towards defensive research in order to develop vaccines and prophylactic measures. Between March 1971 and February 1973, all stockpiles were destroyed.

The decision was dictated, apart from moral and legal reasons, by pragmatic reasons as well (Tucker 1993). The technological advancement in the field of chemical and nuclear weapons made biological weapons unnecessary for national security, especially when compared to the destructive force of its nuclear counterparts (Poupard & Miller 1992). Their potential strategic usefulness was unverifiable as it was impossible to conduct field tests, due to public health concerns, and as such they were deemed untested, unpredictable and dangerous not only for the enemies but also for the users. Furthermore the risk of horizontal proliferation of such low-cost weapons was impossible to overlook, thereby accentuating the need to translate the arms race into solely nuclear terms, whose cost was prohibitive at the time (LTC George W. Christopher et al. 1997). The public opinion seems to have played an important role too, as the US Army was heavily criticized for the use of chemical herbicides and riot control agents during the Vietnam War (Dando 2006, p. 39).

Following the end of World War II, the Soviet program, which was under the supervision of the Red Army, gained some traction with new research being conducted in agents such as anthrax, tularemia, brucellosis, plague, Venezuelan equine encephalitis, typhus, Q fever, and botulinum toxin (Moodie 2001).

Throughout the Cold War the two camps accused one another on the issue, but without providing irrefutable evidence. For instance the former Secretary of State, Alexander Haig, accused in 1981 the Soviet Union and its satellites of providing the communist states of Vietnam, Laos and Cambodia with the mycotoxin T-2 for offensive purposes (Tucker 1993). Refugees from the area described various types of attacks, of which the most notable was the drop of a sticky yellow liquid from planes or helicopters, the so called “Yellow Rain” (Brigadier General Zajtchuk (ed.) 1997, p. 421). However, due to the remote location and the contradictory statements of the survivors, the intelligence agencies were unable to collect viable samples proving the case, as everything that was collected pointed to feces from swarms of honey bees (LTC George W. Christopher et al. 1997).

4.5 The 1972 Convention

Near the end of the ‘60s, widespread concern over the indiscriminate and unpredictable nature of bioweapons, which have been now discounted by military strategists, along with the underlying epidemiological risks and the lack of functioning measures, in conjunction with the ineffectiveness of the Geneva Protocol, pushed the United Kingdom into submitting (July 1969) a proposal before the 1st Committee of the General Assembly of the United Nations for Disarmament and International Security (DISEC). The proposal prohibited the development, production and storage of bioweapons, including a provision for inspections, in case of allegations. Two months later, on September 1969, the Member-States of the Warsaw Pact submitted a similar proposal, without the provision for inspections (Brigadier General Zajtchuk (ed.) 1997, p. 419), while a few months later, on January 1970, WHO put together a report on the fallout of a biological or chemical attack, calculating that a small scale attack would have casualties reaching into the five-digits (Consultants 1970).

In 1972, the "*Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction*" was signed, entering into effect on March 1975. The three sponsoring states were the US, the United Kingdom and the Soviet Union (Sims 2007). Today, 180 Member-States have signed and ratified the Convention (UN Office for Disarmament Affairs 2018).

The Convention was original enough that it left almost no loopholes, as it banned an entire class of weapons (Kadlec, Zelicoff & Vrtis 1997). The text clearly states that the Convention cannot be "*interpreted as in any way limiting or detracting from the obligations"* (ar. 8) assumed under the 1925 Geneva Protocol, and as such the 1972 efforts are complimentary to the text signed during the inter-war period (Sims 2007).

The Convention prohibits the signatory parties from developing, producing and stockpiling "*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 or weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict*" (ar. 1).

Furthermore, the signatory parties are obligated to either destroy or divert the weapons they possess to peaceful usage (ar.2). Similarly, all parties "*undertake not to transfer to any recipient whatsover, directly or indirectly, and not in any way to assist, encourage, or induce any State, group of States or international organisations to manufacture or otherwise acquire any of the agents, toxins, weapons, equipment or means of delivery"* (ar. 3).

Additionally, the Convention allows the signatory countries to lodge a complaint before the United Nations Security Council, in case they deem another signatory country is violating its obligations (ar. 6). Of particular importance is ar. 12 which allows the review of the Convention in case the majority of the signatory states wish it, providing, as such, the diplomatic means for further evolution of the text and ensuring its long-term viability (Poupard & Miller 1992).

The Convention allows for the periodical review, and since it entered into force the signatory states have decided to convene Review Conferences, apart from the 1980 Review, which was dictated by ar. 12 in order to take into account all new technological developments five years after the Convention entered into force. Since then every five years (1986, 1991, 1996, 2001-2002, 2006, 2011, 2016) the signatory states come together to look into ways to make the Convention more effective (Sims 2007) (United Nations Office at Geneva 2017).

In an effort to increase transparency, in the subsequent review conferences following the signature of the Convention, Member-States are encouraged to annually exchange data concerning high-containment facilities, human vaccine production facilities, military biodefense programs, and outbreaks of disease. The process was formalized during the Second Review Conference in 1986, creating what is known today as the BWC-Confidence Building Measures (CBMs). The measures were expanded during the Third Conference (1991) and were further improved during the Sixth Conference (2006) (UN Office for Disarmament Affairs 2015).

The Third Conference introduced another novelty by agreeing to create an Ad Hoc Group of Governmental Experts, which were commonly known as "Verification Experts" (VEREX), whose task was to identify, examine, and evaluate all verification measures from a technical point of view (Kadlec, Zelicoff & Vrtis 1997). However, their report was alarming and pointed out the impossible nature of the task at hand, concluding that it was impossible for such measures to be of high positive and negative predictive value.

A Special Conference was convened in 1994 and it established an Ad Hoc Group (Sims 2007) whose task was two-fold: continue the VEREX Group's work and continue looking into an inspection mechanism and start drafting proposals for a legally binding text, so as to strengthen the Convention (Kadlec, Zelicoff & Vrtis 1997).

4.6 After the Convention of 1972

4.6.1 Soviet Union: assassinations with bioweapons and accidents

After the United States shut down its program, the Soviet Union was the leader in the field, and conducted research into the most lethal bacteria and viruses known to man. The main reason behind this incessant drive to manufacture the world's most lethal weapon was the false assumption that the US, in spite of Nixon's policy shift, continued to conduct research for offensive purposes (Furmanski 2006).

The Soviet program was multi-faceted and revolved around three axes: strategic biological weapons, operational biological weapons, and strategic-operational biological weapons. Strategic bioweapons used agents such as the smallpox and the plague, intended for long-range usage away from the Soviet army. Operational bioweapons were intended for use against deep military targets about 100 to 150 kilometers behind the front lines and included agents such as tularemia and brucellosis. Finally, strategic-operational bioweapons were used for all cases in between and utilized agents such as rickettsial disease and Q fever along with anthrax (Tucker 1999).

For the Kremlin, the biological weapons were only to be used as a last resort in “all-out war”, endangering mutually assured destruction for both the United States and the Soviet Union, and were to be used along with nuclear weapons in such a scenario (Tucker 1999).

Despite signing and ratifying the 1972 Convention, the Soviet Union did not stop using bioweapons. The most notable use is the assassination of Bulgarian defector Georgi Markov in London by Bulgarian secret services (Dr. Crompton & Dr. Gall 1980).

On 7 September 1978, while Markov was waiting for the bus to get to his office, he felt an acute pinch on the back of his thigh and turned around to look. He saw a man picking up his umbrella, who apologized with a heavy and foreign accent, before leaving with a taxi. Soon a swell formed, but he returned home at the end of the day. The following day he presented with high fever and vomiting, while later in the afternoon he had trouble speaking. The same night he was admitted to the hospital and the doctors drew his blood, which tested later on negative for septicemia. Soon after, Markov presented with acute renal failure, and heart problems while a few hours before his death he presented with confusion. He passed away on 11 September 1978, just four days after the incident with the unknown man (Dr. Crompton & Dr. Gall 1980).

According to the doctor that performed the autopsy, Dr. Rufus Crompton, cause of death was toxaemia, which is blood poisoning by toxins, as a direct result of metallic foreign body implantation, a pellet, which was found lodged in his thigh muscle tissue (Dr. Crompton & Dr. Gall 1980).

However, that incident was not isolated. On June 1978 Bulgarian national Vladimir Kostov defected to Paris. In 26 August 1978, two weeks before Markov’s assassination, Kostov heard the discharge of an air pistol and felt a blow in the back, similar to what Markov had felt. He remained in the hospital for 12 days, with high fever which eventually subsided. After Markov’s passing, the British Anti-Terrorist Squad paid him a visit, and after he was subjected to a series of X-rays, a pellet was recovered, similar to the one found in Markov.

After comparing the two pellets, as well as the tissue taken from Markov, no toxins were identified, but the bizarre circumstances surrounding Markov’s death along with the general clinical image both Bulgarians presented with, led the doctors into considering other types of toxins, both chemical –even though only a handful of candidates fit the profile- and vegetal, which amounted to thousands due to their abundance in the animal and plant kingdom (Dr. Crompton & Dr. Gall 1980).

Fast forward to a few days later and based on the clinical and pathological image the doctors identified the toxin as ricin, a naturally occurring toxin produced in the seeds of the castor oil plant*, Ricinus communis* (Brigadier General Zajtchuk (ed.) 1997, p. 420). The toxin is said to have been supplied by the Soviet KGB-run Laboratory 12, which specialized in substances meant to cause a quick and effective death (Zanders 1999).

In 1973, only a year after the Soviet Union signed the 1972 landmark Convention, the Kremlin decided to launch a second biological weapons program to step up its efforts, paralleling the military-run first, but with different objectives and under a different leadership. Its main goal was to create dual use infrastructure, meaning that biological weapons could be produced and mobilized using civilian means. The "Biopreparat" was a huge and costly endeavor, which cost the strained Soviet budget millions of rubles at its peak, but nevertheless remained for the most part a well-kept secret (Moodie 2001).

The Western intelligence was in the dark and only truly understood the enormity of the second Soviet biological weapons program after the Soviet biologist and bioweaponeer, Vladimir Pasechnik defected to the United Kingdom in 1989 (Moodie 2001), who revealed a network of civilian research institutes, which constituted the network of Biopreparat.

In the 1980s it had developed antibiotic-resistant strains of plague, anthrax, tularemia, and glanders (Tucker 1999). According to Pasechnik, Biopreparat was looking into ways to genetically engineer certain pathogens, in order to be resistant to Western drugs (Colonel Ainscough 2002). The program was in large part successful, as in 1983 a laboratory outside of Moscow managed to develop the first superplague, a new strain of tularemia that showed very promising results that led Kremlin to give the order for the development of a more lethal strain of pneumonic plague. Pasechnik claimed that the Soviet facilities were so enormous that they were capable of manufacturing 200kg of superplague per week, but due to the half-life of the agents production never reached that scale. For comparison, 200kg of deadly pathogens can kill up to 500.000 people (Brigadier General Zajtchuk (ed.) 1997, p. 454).

Pasechnik's account was corroborated in 1992, when another biologist defected to the UK. His name remained classified and was only referred to as "Temple Fortune". He not only confirmed Pasechnik's story but also provided further details for the 30-month interval between the two defections. In the meantime the Soviets had managed to further enhance their superplague, which was not only more resistant to antibiotics, but also during storage it remained non-virulent and could be "activated" in the weaponization stage (Colonel Ainscough 2002).

The third Soviet defector was Dr. Kenneth Alibek, formerly Kanatjan Alibekov, who used to work for Biopreparat between the years 1975-1992, and who claimed that the Soviet Union did use its bioweapons on the field; in 1982 against the Mujahideen in Afghanistan, when glanders (*Pseudomonas mallei*) was deployed with the intent to kill horses and severely incapacitate humans (Tucker 1999).

Alibek's account also provided further details about the Soviet program, which counted a grand total of 52 different agents, or combination of agents, including deadly viruses such as Ebola, Marburg and smallpox, but the most favorite ones, which were incorporated into the Soviet war doctrine were anthrax, Pasechnik's superplague and a specific strain of tularemia, all of which were modified to be immune against modern treatments (Colonel Ainscough 2002).

After the three defections, US President George Bush and UK Prime Minister Margaret Thatcher decided to confront Soviet President Mikhail Gorbachev. In response to the pressure, Gorbachev invited American and British representatives to visit the facilities where Pasechnik had worked. Prior to the visit itself, the protracted negotiations needed to hammer out the details allowed the Soviets enough time so as to "clean up" their facilities. The inspections did not go smoothly as on various points throughout the visit access was denied to certain parts of the laboratories for "security purposes". The visit was reciprocated in 1992 when a Soviet team visited several US facilities, under the supervision of the British delegation. The Soviets concluded that the US had "*mothball capabilities*", as the biological weapons program was terminated under Nixon and all facilities were decommissioned by 1972 (Kelly 2002, pp. 94-96).

In January 1992 Russian President Boris Yeltsin admitted that Russia was conducting research into weaponized pathogens, which he characterized as "*lag in implementing*" the 1972 Convention (Moodie 2001) and decreed that all activities against the 1972 Convention would be outlawed (Brigadier General Zajtchuk (ed.) 1997, p. 453).

A few months after the admission Russia managed to come to an agreement with the United Kingdom and the US, which is officially known as the Trilateral Agreement, in 14 September 1992 (Kelly 2002, p. 97). Its main goals were to instill confidence that the Russian program would be dismantled, while committing Russia to inspections, conversion of the military facilities into civilian ones and termination of offensive research programs (Brigadier General Zajtchuk (ed.) 1997, p. 455).

The Agreement failed dramatically as Russia was unwilling to acknowledge and to fully account for its current of previous biological programs. The main reason, though, for the Agreement's failure can be attributed to mostly bureaucratic errors, such as issues of reciprocity, that allowed the three parties to dodge the main issue, while remaining faithful to the letter of the Agreement (Kelly 2002, pp. 105-106).

However, even prior to Yeltsin's admission, the intelligence community was –at least in part- aware of the Soviet program, especially after an epidemic of pulmonary anthrax broke out in the city of Sverdlovsk (or Yekaterinburg), in Central Russia in 1979, which Yeltsin acknowledged as an accidental release and not a natural occurrence in 1992 (Moodie 2001).

In the region there was a Soviet lab which, according to the intelligence services, was used as a bioweapons research facility. The US accused the Soviet Union for the operation of a defense laboratory nearby, which was denied by the Kremlin, and the whole incident was attributed to contaminated black market meat (Poupard & Miller 1992). Later Yeltsin revealed that the air filters were activated with delay, resulting in the accidental release of anthrax spores, which mostly affected livestock and through the food-chain ended up affecting humans too. Reports are conflicting about how many people were affected (Tucker 1999) (LTC George W. Christopher et al. 1997). The 1979 incident was largely ignored by the policymakers during the First Review Conference of the Convention in 1980 (Poupard & Miller 1992).

4.6.2 Iraq

Iraq had signed the 1925 Protocol, with the same reservation as most signatory states: it reserved the right to retaliate with biological weapons. It also signed the 1972 Convention, although the ratification was forced on the Iraqi government in accordance with the provisions of UNSC Resolution 687 (8 April 1991), which was passed after Iraq's swift defeat during the Persian Gulf War.

During the late 1970s, Saddam Hussein decided to launch covertly a biological weapons program along with nuclear and chemical programs. He did not wish to use them in the field, but rather deter and intimidate his enemies, Israel and Iran. Baghdad's efforts were supported unwittingly by foreign companies, because the advancement in biotechnology in Iraq at the time was in its early stages and could not sustain a significant bioweapons program (Tucker 1993).

It was reasonable for Baghdad to study a series of microbial pathogens, which were endemic in the region and as such did not attract international attention (Tucker 1993). For this reason anthrax and botulinum toxin were chosen, as other countries had already used them for the same purposes, and have already proven that they were easy to produce. Near the end of the Iran-Iraq war the laboratories began research into a bacterium called *Clostridium perfringens*, which is mostly found in decaying vegetation, and fungal toxins such as aflatoxin (Brigadier General Zajtchuk (ed.) 1997, p. 421). Furthermore, in 1988 the first field trials for crude dissemination mechanisms were conducted, signaling that the Iraqi biological program had truly taken off especially in the 1990s, when the prospect of war with UN forces was a real possibility. At that time, more sophisticated methods of delivery were developed. (Dando 2006, pp. 51-52).

It is worth noting that just before the beginning of the Persian Gulf War, the authority to launch biological weapons was delegated to the regional commanders, in case Baghdad was hit in a decapitating strike. The UN later looked into this decision, and concluded that this included usage for purposes other than retaliation (Dando 2006, p. 53).

Because the intelligence agencies had reasonable –and correct in hindsight- suspicions that the Iraqi regime had launched an ambitious bioweapons program, the allied forces started preparing, so that the soldiers could be well prepared and familiarize themselves with the masks and the decontamination protocols, while they were receiving vaccines counter toxins *en masse* (LTC George W. Christopher et al. 1997) (Tucker 1993). In spite of all the preparation, one Pentagon report highlights that although Saddam Hussein's chemical program is quite threatening, on the contrary, his biological program was far less advanced and threatening. Shortly after the invasion, only the Defence Intelligence Agency (DIA) noted that he had, in fact, weaponized anthrax and botulinum. However, slowly the US intelligence community began to change its mind, and by October 1990 it was widely believed that its botulinum toxin could inflict casualties as soon as four hours after deployment. As such the threat level was immediately reassessed, even though, according to intelligence reports, Iraq would have to use crude delivery means and not sophisticated means allowing for aerosolization (Tucker 1993).

By the time of the invasion of Kuwait in 2 August 1990, the Iraqi regime had spent approximately $100 million on its bioweapons program over the previous decade (Tucker 1993) and the public interest on the issue was renewed.

Iraq's program was not kept secret for long, as the former Central Intelligence Agency (CIA) Director William H. Webster, during a speech on September 1990, noted that Iraq had "*a sizeable stockpile*" of bioweapons, but clarified that the regime did not possess the necessary delivery means. Ten days later the Chairman of the House Armed Services Committee, Les Aspin, made an announcement following Webster's line for the most part. On the other side of the Atlantic, Prime Minister Margaret Thatcher announced on November before the House of Commons that "*We believe that [Saddam Hussein] also has biological weapons at his disposal*". (Tucker 1993)

Even though most assessments remain to this day classified, the threat Saddam posed was considered significant enough to mobilize the big players in both coasts of the Atlantic. This was further exacerbated by Saddam's inflammatory rhetoric and his willingness to unleash chaos upon civilians, as evidenced by his willingness to use chemical weapons during the Iran-Iraq war (Tucker 1993).

During the air campaign phase of Operation "Desert Storm", in 1991, high priority was given to the destruction of key-facilities for Saddam's bioweapons program.

Intelligence confirmed, to an extent, the existence of such a program after the Persian Gulf War during routine inspections. The UN inspection teams reported that the Iraqi regime had engaged in the pilot production of biological and toxin agents, but there were no indications of large-scale production or any evidence suggesting that the regime had the capability of loading biological agents into munitions for delivery. On the contrary, US officials were adamant that Iraq had fully weaponized bioweapons, but no hard evidence to support the claim (Tucker 1993).

Furthermore, following the defection of Iraqi General Hussein Kamal Hassan on 7 August 1995 the intelligence community learned of a more sophisticated program, which conducted research on anthrax, rotavirus, camel pox, aflatoxin, botulinum toxins and mycotoxins, even though for reasons unknown they were never deployed in the field (Brigadier General Zajtchuk (ed.) 1997, p. 421). It is assumed that Saddam Hussein was terrified of the retaliation, in the event he ever launched a biological attack (LTC George W. Christopher et al. 1997).

The Iraqi regime stated that it had destroyed its biological arsenal, while the United Nations Special Commission on Iraq (UNSCOM) reported having decommissioned all facilities until 1996 (LTC George W. Christopher et al. 1997).

Nevertheless, the story didn't end there, although most of the events leading up to the Second Gulf War still remain shrouded in mystery, particularly as far as Iraq's biological weapons program is concerned. Although the International Atomic Energy Agency cleared Baghdad, clearly stating that the regime did not possess nuclear weapons, the powers that were at Washington wanted a political reason to legitimize their 2003 invasion, because the "Coalition of the Willing" was to operate pre-emptively in order to neutralize Iraq's weapons of mass destruction. As a result, military action relied heavily on the allegations about biological weapons, despite the fact that subsequent searches in 2002 yielded no results (Furmanski 2006).

These allegations, though, were backed up by HUMINT as Iraqi defectors claimed that the Iraqi program was operational again. The most well-known source is a man named Adnan Ihsan Saeed al- Haideri, a civil engineer who claimed to have worked in over 20 facilities. In spite of the lack of corroborating evidence, his claims were taken at heart by the US policy makers. In hindsight, all eyewitness accounts seem to have been fabricated for the sole purpose of causing the US to invade Iraq and ultimately topple Saddam Hussein (Furmanski 2006).

4.6.3 South Africa

Apartheid-era South Africa had launched a small scale chemical and biological weapons program, called "Project Coast", as a means for the white elite to retain its power at any cost. Information surrounding the issue became scarcely available in the 1990s, following a sting, which led to the arrest of the head of the program.

In 1997, South African Walter Basson, cardiologist, was arrested after the authorities received a tip from the American CIA that Basson might attempt to flee the country (Dando 2006, p. 54). The following year the landmark "Truth and Reconciliation Committee" examined evidence, which slowly showed the truth behind the infamous Project Coast.

After the end of World War II, South Africa continued some basic research into bioweapons, funded by the government and supported by universities. Slowly but steadily, the government increased its efforts, which culminated in the 1980s, when the white regime started realizing the impact of its international isolation, combined with the ever-present communist threat and the increasing Black majority. However, due to a regime shift in the early 1990s, the project was shut down in 1995 (Singh 2008).

Basically, the South African program was looking into ways to develop an agent that would selectively target Black people. The eugenics agenda of Project Coast was further elaborated by Dr. Adriaan Goosen, founder of one of the front companies that were set up in order to fund the project. He testified that the government would use this strain not only to maintain peace between the two groups but also stay in power. He also added that the project was successful in creating an almost undetectable and untraceable anti-fertility vaccine, which would be used to selectively target the Black majority (Singh 2008).

During the blame-game that followed, Basson denied that it was biologically, genetically and physically possible to create an ethnic weapon. Nevertheless, a series of testimonies all point to potentially genocide motives behind Project Coast (Singh 2008).

In the final report released by the TRC, the project was condemned in the harshest terms. In terms of agents, the report found that "*cholera, botulism, anthrax, chemical poisoning and the large-scale manufacture of drugs of abuse, allegedly for purposes of crowd control, were among the projects of the program"* and that "*chemicals, poisons and lethal micro-organisms were produced for use against individuals and 'applicators' (murder weapons) developed for their administration*". (Commission 2018)

5 Biological weapons in the 21st century

In the post-Cold War world, security threats have been redefined, becoming broader so as to include aspects that were previously overlooked by both the academic and political community. Namely, the 21st century has seen four trends that exponentially increase biological threats: advances in science and technology, the emergence of new diseases, globalization, and the changing nature of conflict, as Koblentz puts it (2010).

Security in the 21s century has radically changed and now includes non-military threats, which are mostly attributed to non-state actors. These new threats without a doubt impair drastically the well-being of society. Environmental disasters attributed to climate change, organized crime, massive refugee flows, and terrorism figure prominently in the list, along with biosecurity threats, which are considered of international importance according to the Security Council (Ullman 1983).

In July 2000 for the first time in history, the United Nations Security Council (UNSC) classified a disease, namely HIV/AIDS, an international security threat by adopting the US-sponsored UNSC Resolution 1308, which stresses that "*the HIV/AIDS pandemic, if unchecked, may pose a risk to stability and security"*. Resolution 1308 linked the deadly virus to "*the potential damaging impact of HIV/AIDS on the health of international peacekeeping personnel*". US Vice President Al Gore specifically mentioned that the epidemic is "*a security crisis because it threatens not just individual citizens, but the very institutions that define and defend the character of a society*." (Koblentz 2010)

The Security Council was largely influenced by a seminal report issued by the US National Intelligence Council titled "The Global Infectious Disease Threat and Its Implications for the United States". The report clearly states in the first few lines "*New and reemerging infectious diseases will pose a rising global health threat and will complicate US and global security over the next 20 years. These diseases will endanger US citizens at home and abroad, threaten US armed forces deployed overseas, and exacerbate social and political instability in key countries and regions in which the United States has significant interests*." (National Intelligence Council 2000)

Evidently, 2000 was a turning point for all national and international security doctrines, which for the first time considered a nontraditional threat, as in the case of HIV/AIDS. For the first time, public health became a matter of national security.

In the few days after the 2001 attack on the World Trade Center, the US announced its firm belief that Al-Qaeda possessed biological weapons, and for this reason, only a month later in October 2001, the Pentagon put boots on the ground in Afghanistan (Furmanski 2006).

Perhaps the most widely-known bioterrorism attack is the post-9/11 envelope attacks, which came shortly after the US invasion of Afghanistan. The attack was terrifying in its simplicity: thousands of letters containing anthrax spores were mailed. The instructions contained inside the letter specifically stressed that the receiver should seek medical attention, because they were already infected, as such announcing that this was indeed a terrorist attack.

The quality of the anthrax included in the letters varied, from crude particles to more refined ones that could be aerosolized, but all of them belonged to the Ames strain, which is considered to be highly virulent (Leitenberg 2002).

Due to difficulty of the process, many specialists at the time toyed with the idea of a state-sponsored attack, and the most speculated culprit was Iraq, mostly due to the fact that it had recently imported material that could well be used in such a case. More specifically, US President George W. Bush on the 24th of October noted that he felt that Al-Qaeda was behind the attacks, with the aid of Iraq (Furmanski 2006). On the other hand, though, the very nature of the attack seemed to contradict the theory of state-sponsorship as the intended receivers of the letters were not chosen haphazardly, but rather by someone with inside knowledge of US politics and a certain grudge, as such dismissing the government of Iraq as a viable suspect (Leitenberg 2002).

A third option was consequently put on the table, which turned out to be true, completely discrediting the Al-Qaeda theory: the idea of an insider, a US national with access to highly-secured facilities. The US government even vetoed a resolution of the UN Security Council sponsored by France meant to condemn the envelope attacks, because Washington considered the attack to be “a domestic criminal matter”. The investigation focused on an American virologist who used to work for the United States Army Medical Research Institute of Infectious Diseases for two years and then worked as a private contractor, in the sector. His position and knowledge allowed him unique insight into production processes and unprecedented access into the anthrax spores themselves (Leitenberg 2002).

According to a report published by the CDC, there were 22 confirmed cases of infection, 11 inhalational and 11 cutaneous. Out of the 11 inhalational cases, 5 were fatal. The letters were mailed to media stations and two members of the US Senate, however, approximately 91% of the cases concerned either mail handlers or people who were exposed to worksites where contaminated mail was processed or received (Jernigan et al. 2002), and therefore it can be concluded that the delivery method chosen was not the most effective ones in order to achieve the strategic goal.

In terms of numbers, the attack itself was rather small-scale and it was adequately dealt with by the public health system. However, its consequences were far-reaching as the psychological and political impact left the American society reeling from an invisible enemy as public expenditure to combat the threat skyrocketed in the billions.

6 Non-State Actors

Having already proved the methodological difficulties surrounding threat assessment on a state-level, it is not a stretch to say that it is almost impossible to predict non-state actors' behavior despite extensive literature on the issue, both pre-9/11 and after. The equation becomes even more obscure when the factor "biological weapons" is added, for the sole reason that there are almost no empirical data. Policymakers rely on factors such as proliferation of technology and know-how in order to make a conservative estimation on the level of vulnerability to a biological attack (Cameron et al. 2000).

6.1 Case studies

Bibliographical research shows almost no incidents involving terrorist organizations and biological weapons. There are three important case studies, which may serve as an important tool in order to better understand society's vulnerabilities and the political motivation behind such an act, but it is unwise to take these cases outside of context, due to the fact that each group is wildly different from the rest, both in terms of incentives and in terms of capabilities.

Although it would be methodologically convenient to take the following case studies and create a formula for future reference, its results would be untrustworthy due to the logical leap taken to arrive to the conclusion: not every group is after the same things.

The threat of a biological attack launched by non-state actors became known in September 1984, when in Oregon, USA dozens of restaurants were infected on purpose with salmonella by the cult Rajneesh. The attack resulted in 751 patients, who presented with gastroenteritis, and 45 patients in need of medical attention. In spite of extensive investigations by the Department of Public Health in Oregon and the CDC, the epidemic was not deemed as an attack at the time, until one year later, in 1985, when a member of the cult admitted to the attack (LTC George W. Christopher et al. 1997). The reason behind the attack was less religious and far more realistic. The cult wanted to affect the election results for county commissioners because they were concerned with land use regulations in Wasco County in Oregon. The plan was to subvert the results and elect someone who would be more favorable towards constructing new international headquarters (Zanders 1999).

The threat, however, did not abate with a more striking example the sarin attack by the Doomsday cult Aum Shinrikyo in the metro of Tokyo, on March 1995. Even though the attack was chemical in nature, police investigation revealed a rudimentary bioweapons program, which relied mostly on anthrax and botulinum toxin, responsible for botulism. Between June-July 1993 the cult conducted at least four attacks using anthrax strains, which were disseminated in the streets of Tokyo from the top of buildings or from the back of trucks. Only the arrest of a member following the sarin attack revealed the anthrax attempts, which remained unannounced for reasons unknown (Chyba 2001). Further investigation brought to light that the members of the cult had visited Zaire in 1992, in order to obtain the Ebola virus, but the attempt was unsuccessful (LTC George W. Christopher et al. 1997).

One of the most highlighted threats was Al-Qaeda's attempt at acquiring biological weapons in laboratories in Sudan and Afghanistan, under Osama Bin Laden (Cameron et al. 2000). The US national-security apparatus firmly believed that Al-Qaeda was pursuing WMD capabilities, or at the very least, was refining its capabilities to reach a crude, rudimentary level allowing for simple dispersion of the lethal biological, chemical and/or radiological materials. Especially after the 9/11 attack, the Al-Qaeda threat was exaggerated significantly as it was impossible to rule out large-scale WMD usage. Numerous intelligence reports at the time used nuanced language, as the officers attempted to "hedge their bets", underlining interest, intent and probability (Parachini 2010).

According to analysts, Al-Qaeda and its affiliates were exploring the options of anthrax bacteria, botulinum toxin, ricin, and to a lesser extent yersinia pestis (plague), naming the Soviet Union as the most likely source of the pathogens (Salama & Hansell 2005).

Did Al-Qaeda want to acquire biological weapons specifically or WMD in general? The academic community is divided on the matter. The first school of thought reasons that after analyzing Osama Bin Laden's way of thinking, it becomes evident that biological weapons were not compatible with his worldview, due to the fact that he did not have an apocalyptic vision of the world, but rather he wished for a world remodeled after the golden era of Islam (Parachini 2010). Of course, the second school of thought strongly disagrees on the matter, noting that acquiring WMD capability was a recurring theme of Bin Laden's rhetoric, as the means to achieve military equality with their aggressors. This stance was adopted by the entire Al-Qaeda leadership, which deemed the US a "dishonorable" opponent, not hesitating to annihilate a weaker adversary but also choosing to back down against a stronger enemy (Salama & Hansell 2005).

However, after the US invasion in Afghanistan several safe houses were raided and treasure troves of intelligence were brought stateside. The documents, although clearly demonstrated that Al-Qaeda was interested in pursuing biological capabilities, showed that the higher-ups did not have a clear and technical understanding of the issue and as a result never imported pathogens (Furmanski 2006).

6.2 What kind of non-state actors would be interested in biological weapons?

In the 21st century it is not a stretch to imagine state-sponsored terrorist attacks, as there are currently rogue states arming terrorist organizations. However, considering the pathogens' destructive power, it would be too risky for a state to hand over such dangerous and volatile materials to a group that is not entirely under its control, especially for pathogens that cause mass casualties. Besides, there is no way the government of the sponsor state can be absolutely certain that it would not be the target of retaliation once the link between the organization and the sponsor state is discovered (Enemark 2006).

It is important to note that one state could become inadvertently a sponsoring state, through the actions of a non-state actor, such as a biologist or a geneticist with unlimited access to the pathogens, who acts on behalf of the state. The person in question for a number of reasons may choose to arm a terrorist organization. History has no shortage of such examples; the feeling of resentment is often the common denominator among the infamous "disgruntled employees", who choose to take matters into their own hands. This decision might also be fueled by personal or family problems, such as health issues, divorce or even substance abuse. The system that handpicks who gets to work in those highly restricted areas is by no means perfect and certain individuals might slip through the cracks. The idea itself is not far-fetched, as evidenced by the envelope attacks in the United States, where it is generally acknowledged that one or more insiders capitalized on their unique access to get the anthrax spores (Leitenberg 2002).

Post-9/11 one of the common problems examined was also the probability of infiltration, where an outsider that had nothing to do with the facility or the government, would gain access to the deadly pathogens (Enemark 2006).

Of course, state sponsorship could occur even after the dissolution of a state, in case the laboratories were not shut down properly. Two simulation exercises, namely Operation Dark Winter (O'Toole, Michael & Inglesby 2002) and Operation Atlantic Storm were launched on the presumption that non-state actors somehow managed to acquire smallpox. Specifically in the case of Operation Atlantic Storm, the scenario stipulated that the fictional organization raided a microbiological facility in the former Soviet Union, which was never properly decommissioned (Hamilton & Smith 2006). The two simulations received heavy criticism due to the fact that it was not deemed probable for a non-state actor to gain access to the highly regulated strain of smallpox (Enemark 2006).

For terrorist organizations, willingness does not automatically equate to biological capabilities, because without a doubt such an endeavor requires ample financial support (Kortepeter & Parker 1999). A rudimentary distinction could be made with regards to the target size of the attack. A large and well-funded group with the appropriate technical expertise exploring a solution that could have a global impact could be a viable candidate. However, these kinds of pathogens are highly-regulated and for this reason they are considered to be of low-probability, even though if such an attack does occur the results will be catastrophic. Less sophisticated organizations, such as the Rajneesh cult, would use readily available pathogens. The third category involves smaller organizations, which only target individuals for assassination purposes or at the most building in order to create havoc. Therefore, as Korpeter and Parker (1999) put it, the size and the funding of an organization play an important role in deciding whether or not they can be suspects.

Another distinction that can be made concerns the relation between means and the end goal. As far as terrorist organizations are concerned two main categories can be identified: those who perceive the act itself as the end, and those who consider the act to be a means to an end.

The first category consists of mostly religious cults, such as the infamous Aum Shinrikyo. Their main goal is to appease their gods and often seek maximum casualties, as they don't expect to survive either the Armageddon. Religious motives change the dynamic of the group, making each one of the consisting individuals believe that extreme violence is an acceptable mechanism for action. To their mind they are their deity's instrument, ready and willing to carry out their wishes, trying to satisfy the deity's desires. The blame, therefore, is placed on the deity and not the individual, who simply carries out orders (Gressang 2001).

The second category, which is by far the most dangerous, includes organizations which are politically motivated. Their actions do not focus so much of physical damage, although it is sought out, but rather on instilling fear. Fear can be used to divert funds, cause mass hysteria, divide the government and undermine the faith of the people in the government itself. The psychological dimension, in this case, is even more dangerous than the actual physical damage (Danzig 2003).

However, Gressang (2001) warns that not all non-state actors are likely candidates to launch a bio-attack. For this reason he proposes a model, which combines the non-state actor's audience, the content of the message and the level of social interaction

The first step is to determine the group's core audience and identify whether it's human or ethereal. The driving force for the actor is the attempt to reach this audience, which is the single most important recipient of the message. Therefore, the audience plays a vital role in determining the degree and scope of violence, as for example, if a group wishes to garner support and empathy from there are certain lines which must not be crossed so as not to alienate the target audience. On the other hand, there are the rare instances where the target audience is a deity and the degree of message acceptance depends solely on the beliefs of the individual. Consequently, these kinds of groups accept one-way communications and although they would prefer a response, it is not a prerequisite.

The second step is to analyze the content of the message, which in most cases can be summarized in "change v. destruction". Most groups advocate social or political change, a better future for their audiences. Other groups fight for the complete annihilation of their enemies, without specific outcomes, as destruction itself is the end. This second category, according to Gressang, is inclined to use weapons of mass destruction, including bioweapons, for the sole reason that they do not care for social survivability.

The third step towards determining whether a group is a viable candidate is to examine the way it perceives its relations with the rest of society. Groups that fight for social or political change consider social interaction to be of the utmost necessity, and wait for some kind of popular response from the society *vis à vis* their demands, expectations and goals. Therefore, the nature and target of the attack is directly related to the expected response from the society. Those who fight for self-determination or freedom from oppression must be very careful as to how the attack is planned, and for this reason they usually target their perceived enemies. Those, though, who blindly accept hateful rhetoric, are more likely to use indiscriminate weapons, as destruction is the end. In summary, a group can either have reciprocal relations with society or inapposite relations, which is the bare minimum allowing for the purchase of the necessary material and equipment and the proselytism of new members. This particular behavior is evidenced among isolationist cults, which only tolerate interaction with society in order to ensure their own survivability.

The most important part of Gressang's model is the conclusion that all three criteria must reach simultaneously the critical level. In that case the group in question should be seriously contemplating the use of bioweapons. If one of the three criteria is not met, then this would signify barriers to launch any such attack.

The model presented has an important methodological flaw that needs to be taken into account, as Gressang uses the blanket term "weapons of mass destruction", without looking into each category on each own. Further to this, he does not make a clear distinction between large scale and small scale weapons that can drastically alter a group's behavior. According to his own reasoning, a group would not want to use large scale, indiscriminate weapons such as the release of a global pandemic due to the dangers for its own audience, but it might consider a small scale, geographically isolated attack like the poisoning of the water reservoirs in a town two oceans away.

6.3 Incentives and disincentives for non-state actors

Suppose a non-state actor, such as a terrorist organization or a religious cult, has decided to use biological weapons in order to achieve its goal. There are many things to consider before embarking on such an endeavor in terms of logistics. Apart from ensuring the production of the biological agent and an efficient delivery system, non-state actors are both blessed and cursed by their own organization.

As the name implies, they operate outside the public sphere, and as such are not bound by international law. They are not touched by either the 1925 Geneva Protocol or the 1972 Convention. However, there are no other advantages to being an organization operating either outside the law or in the undetermined grey area.

Before even contemplating the advantages of a biological attack, such groups must face a variety of deficiencies with regards to resources and organizational structure, as well as problems that may arise during the execution of the attack.

Initially, a non-state actor must consider its goal. Assuming that its goal is territorially-limited and does not seek global catastrophe, a group would be reluctant to use such indiscriminate weapons, which would put their own people, members and followers alike, at risk. Although using unconventional weapons would be considered beneficial against state-organized armies, the political gains envisioned by non-state actors, such as independency, autonomy or legislation, limit the type of weapons that could be deployed, because their own audience might be severely hurt (Gressang 2001). For instance, in an area with mixed population a bioweapon would equally infect both constituencies, thereby defeating the purpose (Enemark 2006).

Additionally, most non-state actors depend greatly on public support as demonstrated above, at the very least in order to meet their recruitment needs. In the event a bioattack is launched two scenarios may unfold: either the attack will go unnoticed and the pathogen will die out naturally, or the government will be alerted, initiating a massive crackdown against the responsible group, as such alienating both supporters and members (Enemark 2006), who will be painted with the darkest colors in a publicity campaign, slashing effectively all funds.

If a group is truly determined to acquire biological weapons, there are a number of issues to consider as the technological challenges that arise are the most decisive (Dando 2005). Not only the production and stockpiling of a pathogen is extremely difficult, as seen above, despite the technological diffusion and dual-use equipment, but also the creation of an effective and reliable delivery system presents significant obstacles that cause non-state actors to reconsider trying "conventional" and proven methods, that require neither scientific know-how, nor specialized equipment (Enemark 2006).

Last but not least, two of the key ingredients to a successful terrorist attack are the subsequent noise to an attack, creating panic in the media causing a ripple effect, along with the instant gratification it provides to the audience of the group, further inviting more supporters to the cause (Enemark 2006). By contrast, a biological attack, unless publicly announced, is silent and delayed, due to the incubation period the pathogens require in order to multiply.

A biological attack does not have the publicity appeal the detonation of a bomb has, because its effects are spread over time, making it impossible to pinpoint one event which can be used for recruitment or even celebrating purposes. Even more so, the media would be unable to access contaminated regions, which would be quarantined by the competent agencies, further diminishing the exposure of the public to the attack and limiting panic.

Therefore, why would a non-state actor choose to launch a biological attack, considering the immense obstacles?

Numbers speak louder than words and in the case of bioterrorism they make a compelling argument. One gram of anthrax, similar to the one mailed to one of the US Senators during the envelope attacks, contains approximately one trillion spores. The lethal dose for an average man is 8.000-10.000 spores. Therefore, during the perfect environmental conditions which would allow for perfect aerosolization and dissemination of the pathogen upon an unsuspecting and unprotected population, 100.000 people could be killed (Danzig 2003). Using the same principle, the number of potential victims increases exponentially.

Although the process of making viable and stable weaponized pathogens presents a technological challenge, once surpassed, nothing can stop the actor that possesses the material: once the production of one gram is accomplished, it is not that difficult to manufacture a kilogram –or ten- of the pathogen in question. Moreover, one attack needs not deplete the entire stockpile, leaving plenty for a second chance or even for sale in the black market for funding purposes (Danzig 2003).

Unlike other types of weapons of mass destruction, attacks involving biological weapons are far less spectacular than their most explosive counterparts, as such enabling a covert action, due to the sensitive nature of the pathogens, which would be destroyed in a fiery explosion. Unless the perpetrator publicly takes the responsibility, the world would never know (Enemark 2006).

The covert nature of such attacks offers another advantage as well, namely the ability to “reload” as Danzig (2003) puts it, which is basically the capacity to pull off a second attack, which could multiply to a terrifying degree the impact of the first one. A repeated attack undermines confidence in the government, in law enforcement agencies as well as in the abilities of the paramedics, causes the markets to crash and pushes lawmakers into a never-ending cycle of increased investments against an invisible enemy (Danzig 2003).

Additionally, technologically speaking, it is challenging to detect the presence of biological agents and their fallout, especially in comparison to detecting the effects of either a chemical or a nuclear attack (Enemark 2006), as it is virtually impossible to distinguish a naturally occurring disease from an intentionally released pathogen.

There are only two ways that could lead to the confirmation of a biological attack: either a terrorist group can publicly announce the launch of such an attack or a large number of patients will be admitted to a hospital or a clinic, presenting with the same symptoms. Even in the latter case the chances of alerting the public are low, owing to the fact that all over the world the public health systems are working at maximum capacity trying to deal with naturally occurring diseases and other medical incidents (Cameron et al. 2000). If the story of a biological attack ever broke, hospitals would be flooded with actual patients but also with healthy citizens demanding medical attention out of fear (Enemark 2006).

The element of fear is without a doubt the most attractive trait of biological weapons (Cameron et al. 2000). Because ordinary people are not trained epidemiologists, their knowledge relies either on the internet or on what they hear/read on the media, and the reaction varies according to the type of infection (Holloway et al. 1997). Each winter hundreds of thousands become infected with the common cold, and yet nobody is concerned. The influenza virus presents with mild, treatable symptoms and fatality rates close to zero. On the other hand, a quick search on the Internet on deadly diseases is enough to terrorize the calmest citizen, as proven by the recent Ebola outbreak in Western Africa;

although the virus itself does not easily allow for human to human transmission, it stroke fear into the hearts of people, because it causes massive hemorrhaging in its victims.

In the case of biological weapons, fear is useful tool because it multiplies exponentially the effect of the attack. Even if only a few people are affected in an area, instantly the avalanche effect will take place and the vast majority of the inhabitants in the study area will visit their doctors for a precautionary check-up, skyrocketing panic levels. Panic is essentially contagious fear, which cases individuals to think only about themselves, especially in an environment with limited resources which are allocated on a "first-come-first-served" basis (Hall et al. 2002).

This mass hysteria, which can be found in the academic literature as "mass sociogenic illness", is a social phenomenon. It occurs when "*two or more people share beliefs about a constellation of symptoms for which no identifiable etiology can be found*" (Hall et al. 2002) and is often triggered by an environmental incident, which has preoccupied the public or even by rumors of an incident (Wessely 2001). The psychological and sociological impact of a biological attack must not be underestimated, and may be even more acute than the actual damage and death toll sustained in the long term (Holloway et al. 1997) as four major health concerns arise: diseases directly caused by the attack and potential chronic problems; increased levels of physical symptoms; questions about the effects on reproduction; psychological effects (Wessely 2001).

The reason behind this attitude is probably the indiscriminate nature of the bioweapons. In the event of a nuclear attack the loss of life and the damage on infrastructure will be impossible to gauge, but for the most part it will be contained in one area. Radiological fallout will spread over, but its impact will be significantly reduced and secondary deaths will spread out over a long period of time. The same applies for chemical attacks, although secondary deaths will be much less due to the preventive measures that will be deployed after the attack itself. However, this is not the case for biological weapons. Patient zero can travel around the world freely and infect hundreds, if not thousands, of people, without ever him realizing that he is the host of a deadly pathogen. Therefore, the effect cannot be geographically contained and the number of people affected cannot be estimated, as everyone and anyone could be infected.

Mankind's ancient and deep-seated fear over something that cannot be seen with the naked eye is one of the primary reasons why biological weapons are so attractive for violent non-state actors: it only takes one whisper of a lethal disease and chaos will ensue, even if the pathogen was never deployed.

While the afore-mentioned factors can explain the behavior of politically-motivated groups, it is worth noting that biological weapons hide a religious significance for Islam and Christianity. In 570 AD, the year the Prophet Mohammed of Islam was born, Abyssinians attacked Mecca for the purpose of destroying Kaaba, one of the most sacred sites for Islam. The Koran says that Allah sent a flock of birds, which dropped stones on the Abyssinian army and instantly sores appeared, spreading like pestilence. In the Bible, the Book of Exodus describes the ten plagues God sent to punish the Pharaoh and persuade him to release the ill-treated Israelis. The fifth plague infected livestock with anthrax. Finally, the Book of Revelations describes the Apocalypse, which will be brought upon by the Four Horsemen. The first Horseman riding a White Horse, according to apocalyptic texts, is “Pestilence” according to various interpretations, albeit not the most canonical ones (Enemark 2006).

Therefore, the prospect of a biological attack is also particularly attractive for apocalyptic cults, prone to mass death, in order to please or appease the deity their cult celebrates. Death is seen as the ultimate purpose and for this reason it is glorified, as such eliminating all moral restraints another group might show, as the victims are considered “infidels” and must be either shown the truth path or purged in order to purify the Earth.

Nevertheless, it must be noted that religiously motivated non-state actors do not see the opinion of the general public as a fundamental driving force behind their actions and as such they may not be hindered by society’s moral boundaries or the potential backlash. The powerful disincentive of technology still applies to such non-state actors, as well as the indiscriminate nature of bioweapons, which albeit depends entirely on the dominating philosophy which could drive the perpetrators to have no interest in their own well-being.

However, past cases demonstrate that, generally, only a handful of groups wish to kickstart a biological apocalypse as is the case of the Japanese Doomsday Cult “Aum Shinrikyo”. For all other groups that ever attempted to acquire biological capabilities or even launched an attack, there is always a clear political motivation that does not allow for indiscriminate killing, because they also desperately need the public’s support, which would not look favorably upon a biological attack, although it would not exclude it either (Cameron et al. 2000).

To summarize the incentives and disincentives for non-state actors with political goals are as follows:

NON-STATE ACTORS WITH POLITICAL GOALS	
INCENTIVES	**DISINCENTIVES**
Not bound by international law	**Indiscriminate nature**
Potency per kilo	**Dependent on public support**
Covert action	**Technological hurdles**
Reload ability	**Silent attack**
Difficult to detect effects	
Fear / Mass hysteria	

NON-STATE ACTORS WITH RELIGIOUS GOALS	
INCENTIVES	**DISINCENTIVES**
Not bound by international law	**Indiscriminate nature**
Bound by religious belief	**Technological hurdles**
Potency per kilo	
Covert action	
Reload ability	
Difficult to detect effects	
Fear / Mass hysteria	

6.4 How real is the danger?

Experts on the issue remain divided over whether or not a bio-attack from a non-state actor is possible, but methodologically it is commonly accepted that the Aum Shinrikyo attack is the starting point. There is general consensus that concern over the possibility of biological terrorism is justified for the sole reason that no state in the world can claim to be fully prepared, in terms of civil defense, to respond to a biological attack.

It can also be said that the academic community retains its skepticism *vis à vis* the usage of biological weapons by non-state actors because in spite of the many incentives, including ease of acquisition, there has been rare use. In general biological weapons are considered to "*constitute a low probability but high-impact risk*" (Szinicz 2005) due to the technical difficulties encountered and their awesome power.

Siegrist (1999) describes in short the three elements that must come together in order for a biological attack to occur meaning a "*vulnerable target, a person or group with the capability to attack, and the intent (by the perpetrator) to carry out such an attack*". This fundamental approach demonstrates that the issue is not the actor that chooses to launch the attack but rather the vulnerability of today's societies. In his article, he examines the typical American society, and finds that the US is unprepared due to lack of equipment, such as pathogen sensors and shortage of prophylactic medicine. However, he also observes that the technologic proliferation cannot be easily countered by states and as such it is difficult to limit the actors' capability and almost impossible to manage the actors' intent. Concluding that currently there are two out of three elements in place, Siegrist emphasizes the need to better prepare the societies for an attack, although he does not opine whether such an attack is imminent or not.

Chyba (2001) takes a cautious approach warning of the negative side of the hype surrounding biological terrorism. While after the collapse of the Soviet Union a number of factors changed, allowing non-state actors to reconsider their tactics, including the proliferation of technology and the tempting idea of asymmetrical warfare against the mighty American military, most instances of biological incidents were hoaxes, with the sole purpose of instilling fear and causing panic. Nevertheless, Chyba clearly advises that the main goal should be to better prepare the society against the spectrum of plausible scenarios even if nothing happens in the end.

Colonel Ainscough of the US Air Force (2002) presents the military side of the debate, which considers the danger to be real enough and increasingly likely, so that a state should be prepared. His reasoning is solidified in the hypothesis that the "*adversaries look for 'asymmetric' advantages*", and as a result biological weapons cannot be ignored. He does recognize, though, that state and non-state actors have different capabilities, although he mostly underlines the different operational training of troops compared to civilians.

Enemark (2006) stresses that policy is somewhat pessimistic, always taking into consideration the worst possible scenario, which in this case is highly destructive, but highlights that even though this approach is "*analytically and politically convenient*" it also is "*expensive and possibly counterproductive*". He argues that policy makers should focus more on the motives of the non-state actor, so as to better prepare the society in the face of a small scale bio-attack, which he considers to be the most likely scenario, taking into account that the most important factor is the scale of the attack contemplated. He makes the distinction between large scale state-run programs and smaller scale, but equally dangerous, programs run by non-state actors, which do not fulfill the criteria to be considered weapons of "mass" destruction, but should be examined thoroughly.

For him, the most important element in bioweapons is not the number of victims per se, but rather the sentiment of fear. As discussed above, it has a catalyzing power and can cause mass disruption in a society, even if only a handful of people were directly affected, as evidenced by the anthrax letters sent out after the 9/11 attack (Danzig 2003). The envelope attacks killed very few people, but arguably their most terrifying characteristic was that they specifically instructed the receiver to take antibiotics, as such announcing the biological attack and causing chaos with new emergency procedures becoming mandatory and over 32.000 issued prescriptions for antibiotics (Enemark 2006).

Gressang (2001) offers an explanation as to why there are not many instances of used bioweapons. Apart from the Tokyo attack, he underlines that there has been limited use of biological, chemical, nuclear or radiological weapons which is mostly geographically confined. He then argues that the reason behind this behavior might be reluctance to use them, as their use might be even considered outside the spectrum of acceptable behavior, even for terrorist organizations, and only an outfit with truly no disregard for social structure and human life would ever consider such an attack.

He then goes on to put the academic debate in terms of past incidents involving non-state actors, setting the Aum Shinrikyo case as the golden standard. On one hand, there are the analysts, who consider an attack using weapons of mass destruction –in general- to be unavoidable, considering that non-state actors crossed the invisible line that separated conventional from non-conventional weapons that fateful day in Tokyo. On the other hand, others consider the Aum Shinrikyo case to be the exception to the rule, owing to the very apocalyptic nature of the group (Gressang 2001).

Nevertheless, the envelope attacks led the public to believe that the most pressing public health issue was bioterrorism, as such causing the lawmakers to earmark unimaginable amounts of money from the strained federal budget in the fight against it, ignoring the soaring numbers infected by more common pathogens such as influenza and the terrifying shortage of vaccines against childhood diseases such as measles and pneumonia (Leitenberg 2002).

Zanders (1999) starts by the premise that terrorist organizations have shown very little interest thus far in acquiring biological weapons. What is most common is their interest in poisonous agents that can be discriminately, meaning that each target, be it human or animal, must be infected separately by the assailant. Additionally, he notes that in every case so far, the agent, which was not a warfare agent, was used in order to achieve immediate and tangible results and not kick off a global pandemic or even cause mass hysteria.

However, he warns that there are several mistakes in the methodology applied to examine the risk of non-state actors acquiring bioweapons. First and foremost, due to the fact that biological weapons are classified as "weapons of mass destruction", often the consequences are highlighted ignoring completely the political motivation behind such a choice and puts the rationality of the perpetrators in question. Secondly, the ease with which the weapons can be found is exaggerated because it is inadvertently compared with the extremely-difficult-to-get nuclear weapons. Thirdly, the probability of the threat is considered to be directly proportionate to the infamous "security deficit", which represents all the threats the state cannot respond to. Therefore, according to this state-centric worldview, because the public health system is vulnerable and lacking –from unprotected ventilation systems to understaffed hospitals, the level of the threat is immense. Lastly, he posits that the analysis is conducted using state reasoning, which is falsely applied to non-state actors. His last argument supports his thesis, that although it is definitely feasible for a non-state actor to get its hands on biological weapons, it is very difficult to recreate the conditions that ultimately led to the Tokyo metro attack and ultimately improbable but not impossible.

Falkenrath (1998)uses a less refined model to consider the probability of an attack, albeit it must be underlined that he, too, uses the blanket-term "weapons of mass destruction" and does not refer to its category separately. For him, the three main factors determining the likeliness of an attack are the capabilities of the non-state actor, its interest in causing mass casualties and its desire to use such weapons. He underlines, though, that all three factors must be fulfilled simultaneously, especially with regards to the first two, which are the two most common characteristics among violent non-state actors in the 21st century.

Nevertheless, he concludes that such an attack is not very likely to happen, due to historical data demonstrating the unwillingness of the non-state actors to use large-scale biological agents –despite several poisoning attempts, which are not held in the same regard for Falkenrath. He centers his argument on mass casualties and mass destructions. For most actors, mass casualties is not the desired outcome, as proven by empirical data, but argues that mass destruction, which is one of the top priorities, can be achieved even without WMD, as seen in 9/11. Apart from these two disincentives leading group leaders to reconsider, he adds heightened health risks to the members of the groups themselves and most importantly the aspect of morality, taking into consideration that WMD carry a special social stigma, especially in the case of biological weapons.

What Falkenrath adds to the debate is the explanation behind unwilling but otherwise capable groups. First of all, he emphasizes the psychological make-up of the groups in question, which in their majority are motivated to kill people but are not driven by a clear-cut purpose, but rather ordered blindly by inner impulses. Taking this reasoning a step further, this would keep them from acquiring biological weapons due to the technical challenges they present. Secondly, he notes that groups that are capable of acquiring WMD are most likely state-sponsored. Therefore, its unwillingness might stem from the unwillingness of the sponsoring state to participate in such a risky endeavor.

On the opposite side of the debate are governments and other state actors in general. While academics mostly agree that a biological terrorist attack is not imminent, States are adopting a different approach. This difference in perception is evident in the World Economic Forum Global Risks Perception Survey for 2017–2018, where two risks are of particular interest to the present paper. First of all, weapons of mass destruction are figure in the first place in terms of impact, although their likelihood is considered to be just below average. To be more precise, the threat of weapons of mass destruction appeared in the top five in 2015, but since 2017 it occupies the first spot. Secondly, the spread of infectious diseases, without clarifying whether it is intentional or natural, figures in the 10th place in terms of impact also scoring below average in terms of likelihood (World Economic Forum 2018).

What these figures demonstrate is that policy-makers are actually concerned that an attack by non-state actors using weapons of mass destruction will occur, even though empirical data offer few case studies. Undoubtedly, this simplistic representation portrays perception and under no circumstances should it be interpreted as plausibility. Nevertheless, what the academic community perceives as “improbable”, governments deem as a “credible threat” with a score of 3/5 (World Economic Forum 2018).

The basic principle employed by all states is the cost effectiveness of an attack. By clarifying, therefore that the cost of a biological attack in terms of repercussions on a personal, political, diplomatic or international level is prohibitive, governments hope to deter any aggressions against their own territory or citizens. This realistic approach is attempting to prevent the acts of a state or non-state actor. In the event something unthinkable does occur, most well-prepared states design their own defense system in order to be self-reliable, considering that all international decisions take time.

This difference of approach between the academic community and governments is best represented in the case of the USA, which shifted its doctrine to elevate the threat of weapons of mass destruction. Consequently is counterterrorism and disaster management program were broadened in the mid-1990s (Falkenrath 2001).

7 Policy proposal

7.1 Criticism

Before getting into matters of civil defense it is important to understand the systemic uncertainties that arise. Firstly, the science behind biological weapons is understood by a limited number of people, and even that understanding varies when taking into account just how unpredictable biological weapons are, considering that they are susceptible to environmental factors and the immunology of the victims. Consequently, a better understanding of the threat itself would lead to better tackling the issue at hand (Falkenrath 2001).

Secondly, continuing on the same line of though, state response in case of an attack depends on the warning (Lt Col Das & Brig Kataria (ret.) 2010), which can be examined from a two-fold aspect: warning before an attack occurs so that it can be prevented and warning after the incident. The first aspect is largely covered by intelligence services, which through the use of HUMINT can keep an eye on potential threats. That way, through the systematic surveillance of candidate terror groups, intelligence services can be prepared and even avert an attack.

But what happens if the first safeguard fails? If an attack is launched covertly then the burden falls upon the physicians all over the country to determine that an attack has occurred, identify the threat and prevent more casualties (Khan, Levitt & Sage 2000), after which the state mechanism must be flexible enough to be able to be activated fairly easily, making sure that the outbreak is caught on time and the public is aware. The same applies in case an organization publicly claims responsibility and even offers details on the attack. The public health system must be able to be mobilized at a moment's notice along with law enforcement agencies and intelligence services. Timely warning in the case of biological weapons might make a difference between one infected person and thousands of infected (Lt Col Das & Brig Kataria (ret.) 2010).

Nevertheless, the unknown factors do not stop there. One of the most appealing characteristics of biological weapons is the psychological impact that can cripple an entire society and make a healthy economy collapse. In case of an attack will training prevail over panic? This vital question concerns not only civilians but also trained emergency personnel, who might abandon everything and run for their lives (Falkenrath 2001). In that case the effectiveness of the response is directly correlated to the public's behavior, with the only problem being that it is impossible to predict how the public will react to the news of a pandemic. In the case of anthrax envelopes the public remained for the most part calm, but the public health system saw an astronomical rise in prescription medicine, indicating that panic had indeed seeped into the homes of ordinary Americans.

These three unknown factors must be added to the equation for the sole reason that they influence all efforts to prevent and respond to a potential biological terrorist attack. Yet the problem continues to get worse: the most prevalent counterterrorism doctrine addresses different types of threats. States all over the world are simply not adequately prepared to handle low-probability but high-impact situations and instead choose to focus on more mathematically-likely types of terrorist attack (Falkenrath 2001).

The problem with policy-making in terms of biological terrorism is the very fact that it relies on science and not empirical data. As demonstrated above there are only a handful of case studies with violent non-state actors that have used biological weapons in the past and for that reason most hypotheses are purely speculative (Furmanski 2006).

Consequently, the policy approach towards bioterrorism is not uniform by any means as the lack of past case studies does not allow for a common, systemic operational understanding of the situation. The very few instances of use of bio-agents by non-state actors are certainly useful because they highlight the security issues but they present a perplexing puzzle of conflicting data as, for one, the actors in question did not have the same motivation (Danzig 2003).

Further to this, the people hammering out the policies come from a variety of backgrounds: from microbiologists to emergency physicians and from military personnel to politicians creating a volatile environment, where it is impossible to find an ideal compromise. Even though the polyphony offers a variety of perspectives, each of these professionals tends to accentuate their point of view and methodological approach (Danzig 2003). For example doctors and physicians in general unanimously demand an increase of their budget because they don't have the necessary personnel and operate most of the time at full capacity. On the other side, politicians are reluctant to address the budget needs because that implies more taxes. Consequently an increase in taxation means that the politician in question will most likely not get re-elected, as evidenced by numerous examples in history. The result of this academic amalgam is incoherence, which in turn makes the policy process highly problematic and the resulting legislation almost dysfunctional.

The threat of bioterrorism has been dealt with so far utilizing existing techniques, whose purpose was to protect the military against chemical weapons and the populace against naturally occurring epidemics (Danzig 2003).

The approach so far consists of a mélange between counterterrorism and disaster management on a national level and therein lays the most significant hurdle: bureaucracy (Falkenrath 2001). The problem of biological weapons is often overlooked by civil servants, who are called upon to resolve a growing number of pressing issues with a limited budget. Therefore, to them the growing academic literature that highlights the low-probability of a biological attack, combined with the by-definition classified aspect of intelligence, only points out a mostly academic debate with no practical consequences for society, which cannot be utilized for re-election purposes.

However, one of the most damaging social consequences is without a doubt the negative impact to the society. As explained above, one of the most prominent characteristics of biological weapons is their ability to instill fear. Therefore, even after the results of the pathogens themselves have been cured, there is always the need to "cure" society of its fear. Psychiatric disability is a likely consequence of a biological attack, as Holloway et. al note (1997) and the most high-risk groups are either the people who were previously traumatized, the ones without social support and the first responders, such as police officers and medical personnel, who will be called upon to handle the crisis.

Apart from those groups the rest of the society is highly susceptible to demoralization (Holloway et al. 1997). The sheer size of managing an operation after a biological attack will place undue stress to the already strained public health system and society will feel that the government and the system is not able to handle the situation, further exacerbating the problem by perpetuating panic.

The problem with the current health system is just how easy it is for it to become overwhelmed. Apart from the most direct outcome, which is the inability to provide effective and efficient health care, there is an indirect outcome, which greatly benefits potential terrorist groups: panicked mayhem leads to discontent, which can be a useful tool in the hands of a group seeking political goals.

7.1.1 The 1972 Convention

One of the most defining aspects of the 1972 Convention is the fact that, contrary to the Treaty on the Non-Proliferation of Nuclear Weapons (1968), no country would be allowed to retain its biological arsenal, as all biological weapons were prohibited strictly and decisively. That was mainly achieved due to the unilateral policy shift launched by US President Nixon only a few years before the Convention entered into force.

In spite of the Convention's optimistic approach it is worth noting that there is no monitoring mechanism to verify that the blanket prohibition is being respected in its entirety. (Kadlec, Zelicoff & Vrtis 1997).

This faux-pas was taken advantage fully by a number of actors such as the Soviet Union, which openly admitted to having a biological weapons program even after it had signed and ratified the Convention, and was able to do so with impunity (Kadlec, Zelicoff & Vrtis 1997), stemming from an equally disturbing lack of enforcing mechanisms. According to ar. 6 of the Convention, "*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*". The rhetorical point is what could have been done in the case of the Cold-War Soviet Union, which held, and still holds as Russian Federation, a permanent seat in the Security Council (OTA 1993).

The only provision for inspections can be found in ar. 6, which stipulates that all signatories to the Convention "*must co-operate in carrying out any investigation which the Security Council may initiate…on the basis of the complaint received by the Council*." This clause creates two fundamental problems: first of all it involves the Security Council, which has limited power for the aforementioned reasons. Secondly, and most importantly, even if a procedure for formal verification were to be included, many technical issues would arise, which are particular to the biological agents. Contrary to chemical agents, or even radiological material, pathogens have the innate ability to reproduce within a host, as such making them extremely potent. The damage inflicted with a few hundred kilos of a chemical agent, could be achieved with only a few kilos of active anthrax, which would be very easy to hide and also very quick to produce. In addition, as explained, almost all equipment required for a rudimentary bioweapons program is dual-use and can be found on the market, making the distinction between illegal activities and legitimate research almost impossible (OTA 1993).

Furthermore, it is impossible to determine adequately the amount of pathogens qualifying for "peaceful purposes" and the treaty does not include a list of permitted activities, therefore making it virtually impossible to ban such research, for the sole reason that nothing is explicitly prohibited. There are no indicators that can differentiate unambiguously between research for offensive purposes and for defensive purposes, as both activities require the exact same technological know-how and equipment. Nonetheless, due to the fact that the industry of biotechnology is far from reaching its peak and exploring its full potential, there are only a handful of legitimate activities (OTA 1993).

A recent example of this ambiguity is the Iraqi program. Although it was subject to strict international inspection, the members of UNSCOM were unable to find evidence that proved without a doubt the presence of an illegal program, even with unrestricted access. Either the program never existed or it was well hidden, capitalizing on the nature of biological weapons. It becomes apparent that intrusive inspections may not always be the correct approach with regards to such an issue (Kadlec, Zelicoff & Vrtis 1997).

The international community has certainly tried to improve the verification measures that support the Convention. However, the VEREX group, which was presented above, concluded that CBMs might not have the desired outcome, apart from increasing confidence and ensuring transparence for the sole reason that they cannot differentiate with absolute certainty between legal and illegal activities with regards to biological weapons research. Another point underlined was the aspect of national security, as it is important to keep in mind that a state's arsenal is undoubtedly the most closely guarded secret. Therefore, the VEREX group concluded that all CBMs must be able to ensure that "*sensitive commercial proprietary information and national security needs were protected*" (Kadlec, Zelicoff & Vrtis 1997).

This problem gives rise to a new concern in the present debate: do national interests outweigh the well-being of society? This moral choice is on the epicenter of most ideological fights, because it puts on the spotlight the relationship between a citizen and the state.

In the context of biological weapons, though, both sides have merits. If a state has an advanced biological weapons arsenal, albeit prohibited and condemned in the eyes of the United Nations, it could act as a deterring factor for all states and non-states wishing harm to its citizens. This logic follows the nuclear logic presented by Baum (2015), in that biological weapons could act as a "winter-safe deterrence", clearly referring to the plausibility of a nuclear winter in the event of a nuclear war. Therefore, if a state manages to keep its citizens safe in a shifting environment, how can an international organ dictate its policy? On the other hand, biological weapons are by nature extremely lethal and highly dangerous because they do not distinguish between hosts. In the event of an accident in a secure facility, the impact to society may be catastrophic, risking an extinction-level even, and all because of human error.

7.2 The approach

"Civil protection" or "emergency preparedness", describes all activities which are meant to protect civilians, as the word implies, against incidents and disasters (Alexander 2002).

The policy proposal concerning civil protection falls largely in the realm of "biosecurity", an ambiguous term with no clear-cut definition. The term was used originally to denominate all efforts against the transmission of naturally occurring diseases in crops and livestock, meaning against threats to the economy and the environment by invasive pathogens. After the rise of bioterrorism, though, the term was redefined, mirroring the shift in international policy. At the epicenter of biosecurity were the pathogens themselves, which were meant to be protected from "*loss, theft, diversion or intentional misuse"*, signaling that the international efforts should be proactive and not reactive. A new aspect was also incorporated so as to cover all dual-use research, encompassing apart from the pathogens themselves, the techniques and technologies required for weaponization or the creation of new organisms (Koblentz 2010).

The most recent and perhaps fullest definition comes from the National Academies of Science, which notes that biosecurity is "*security against the inadvertent, inappropriate, or intentional malicious or malevolent use of potentially dangerous biological agents or biotechnology, including the development, production, stockpiling, or use of biological weapons as well as outbreaks of newly emergent and epidemic disease*" (Institute of Medicine & National Research Council 2006, p. 32). Evidently this new definition includes all afore-mentioned aspects.

To put it simply, biosecurity deals with a spectrum of threats ranging from naturally occurring diseases to deliberate misuses as Taylor (2006) puts it, placing emphasis on the cause rather than the intensity of the disease itself. This model, far from perfect, is a useful starting point for the planning of biosecurity.

One of the fundamentals in establishing a new system is the recognized need for a global taxonomy of threats. Efforts thus far have been underwhelming as a variety of disciplines must work together in order to produce a new and efficient classification system. In the unlikely event a biological attack does occur, today's globalized society needs to be able to act fast and decisively. Nevertheless, a number of inhibiting factors arise: first of all the very estimation of the consequences of an intentional pandemic is almost impossible for the sole reason that there is not sufficient data that would serve as a baseline, and as a result all tentative analyses are vulnerable to scrutiny. Secondly, the sensationalisation of a biological attack causes both private citizens and government officials to wildly overestimate the threat, in essence pumping resources into the wrong place.

Thirdly, the variety of deadly pathogens begs the question: how best prepare the system against an enemy with countless faces? The answer is to establish "all hazard" safeguards. These safeguards basically fortify the concept of public health emergency preparedness with specific defenses against naturally occurring pandemics and biological terrorism ensuring an adequate response. Undoubtedly the main focus should be mostly on surveillance and methods to identify whether an outbreak is intentional or natural (Koblentz 2010).

In this aspect, preparing for a biological attack is very different than the approach used for chemical and nuclear weapons, in that the main weapons against lethal pathogens is mostly proactive, in order to prevent the catastrophe, rather than reactive, after the crisis has hit (Koblentz 2012). Undoubtedly, the effects of a small and medium scale biological attack can be mitigated through accurate diagnosis and effective treatment. That is not to say that a state is not obligated to be prepared, because there is always the chance of a situation going horribly wrong, as for instance an outbreak that gets out of hand. This policy doctrine is applied in most counterterrorism aspects, which highlight the need to "deny access" to the violent non-state actors, by enhancing physical security in high-value targets (Falkenrath 2001).

In that spirit, a comprehensive plan must address not only the physical vulnerability of high-value targets but also the vulnerability of the society as a whole, which will allow the improvement of operational capabilities as such an approach eliminates the unstable human factor (Falkenrath 2001).

In order to correct the system, the international community must realize that the biological threat, albeit of low probability, concerns all of mankind regardless of borders or political motivation. On an international level, though, all policy-proposals must take into consideration one striking truth: all efforts of cooperation and coordination, however innocent and altruistic may be, will be regarded with mistrust and suspicion (Chyba 2001). But the case in favor of international coordination speaks for itself.

Imagine that a citizen of X country falls victim to particularly virulent strain of salmonella, but he has not yet realized. He travels to Y country, where he begins to exhibit the very first symptoms, and subsequently infects other citizens of Y country, which immediately must kick start its public health system to counter the threat, even though the original infection took place in a different country. Even if Y country chooses to go on full lockdown and close of its borders, pathogens can travel freely either through air and water or through alternative hosts such as animals.

This basic example demonstrates the very problem with weaponized pathogens: the release may take place in a different country rather than the ultimate target, and without the full cooperation of all governments it is easy to overlook certain incidents. Therefore the solutions to the biological threat are global (Koblentz 2012).

Consequently, he next step towards ensuring that the nightmarish scenarios remain between the pages of an academic article is ensuring effective global surveillance of unusual or suspicious outbreaks, preventing mass casualties and eventually deterring both states and non-state organizations from launching an attack (Kadlec, Zelicoff & Vrtis 1997).

However, particularly in the case of non-state actors deterrence can prove to be tricky due to the fact that they are entities without fixed territory, which would allow for deterrence in the traditional sense of the term; even more so when the particularly attractive characteristic of fear is added to the mix, it becomes clear that a first strike using biological weapons is highly sought after.

The following policy proposal will revolve primarily around national preparedness, which will include the public health system, and secondly around international efforts by various specialized organizations such as WHO and the European Centre for Disease Prevention and Control (ECDC). Additionally, this second part will cover the 1972 Convention. Finally, the last part will examine the role of intelligence agencies.

7.2.1 National emergency response

The motto behind this policy proposal is undoubtedly "preparation". Seeing that it is impossible to manage violent non-state actors, policy makers must realize that the only way forward is to prepare the society and the citizens for what may or may not come (Siegrist 1999). If the fear of sounding alarmist, apart from the budget strains that are associated with such a systemic renovation, there are no drawbacks in ensuring that the public is informed and ready to spring into action. The very fact that the enemy and his weapons cannot be controlled should be reason enough for a major policy shift. Even if the odds are deemed low, the governments cannot ignore their own vulnerabilities that can be exploited at any given moment.

Of course, preparation can only get states so far before an attack does occur. After this point the entire system gravitates towards disaster management, aka protecting properties and "*meeting basic human needs during and after all kinds of disasters*" as Falkenrath (2001) puts it.

The process begins at a local level, where the first patient will present his or her symptoms. Traditionally, local agencies focus mostly on preparedness and response rather than prevention, which concern the national counterterrorism doctrine. Local agencies will only alert their national counterparts in extreme cases, where the outbreak either cannot be contained or cannot be identified (McLoughlin 1985). Therefore it becomes apparent that local health agencies must be "capable of detecting unusual patterns of disease or injury" and be properly equipped to respond to "clusters of rare, unusual, or unexplained illnesses". One of the ways to support local surveillance efforts is the promotion of partnerships between hospitals and health care facilities, so as to enhance detection and reporting of unusual biological phenomena with the use of specialized algorithms and statistical methods (Khan, Levitt & Sage 2000).

However the very nature of a biological attack (a low-probability, highly-impactful attack against an enormously vulnerable society) presents technical hurdles in terms of addressing the disaster, which can be very quickly taken to a national level. The problem lays not in identifying all the plausible scenarios that could occur but rather define the disaster management program's goals taking into account the systemic complexity, including the legal dimensions of putting an entire country on high alert (Falkenrath 2001).

The main question that should be asked is how well-prepared must a state be in order to be able to sustain in the long term its operational readiness. If the system is always on high-alert, this undoubtedly creates undue pressure and drains all economic resources, with the added negative effect of causing excess psychological stress to the personnel that might lead them to respond ineffectively to a given situation. Nonetheless, there is no golden standard which must be followed that dictates the level of preparedness, considering that there have only been small-scale biological attacks by violent non-state actors.

The bottom line is that without a clear vision, policy-makers cannot compare the program's success or failure, with the result being rising expenditures that will in theory amend a never-tested system (Fraser & Dando 2001).

For this reason the compilation of a preparedness index is deemed of utmost importance. Essentially, this system calculates how much a state is prepared, able to respond and recover from an emergency based on a number of factors such as health surveillance, according to data submitted by regions, community planning and healthcare delivery (Lt Col Das & Brig Kataria (ret.) 2010). As a tool, this index can assist policy-makers in clarifying the goals of the emergency response and evaluate the desirable level of preparedness. To put it in perspective, worldwide there is only a handful of methodologically accurate indexes that can be invaluable to governments and citizens alike, with the most notable being the National Health Security Preparedness Index, which covers the USA (NHSPI 2018).

It becomes apparent that the system must be well made so as to minimize confusion and inter-agency competitiveness by establishing a single national body responsible for dealing with this exact situation.

The first issue that must be addressed is which government sector will oversee this newly established body. In most cases, such as in the US (CDC) and Greece (Hellenic Center for Disease Control &

Prevention-KEELPNO), this responsibility rests with the Department and Ministry of Health respectively. However, this strict categorization is not always followed. In 2005, during a particularly worrisome influenza epidemic, the Israeli Ministry of Health chose to delegate national preparedness and response to the Ministry of Defense, due to the fact that the latter has the appropriate capabilities to facilitate inter-agency cooperation, although the Ministry of Health remained a partner in all decisions to its specialization on the matter. This decision may seem counterintuitive due to specific nature of the threat, but in the context of Israel it makes sense, considering that its defense sector is well developed (Kohn et al. 2010).

Therefore this new model of “civilian-defense collaboration” as Kohn et al. (2010) name it, should not be dismissed out of hand, especially if the outbreak gets out of hand. If the political elite deem the civilian sector unfit to handle the crisis, then responsibility can be transferred at a moment’s notice to the defense forces of a country, particularly if the outbreak presents a national security threat. Of course, the Israeli model may not be applicable to other countries taking into consideration the country’s particular security characteristics including the government model, the small geographical and population size.

Nevertheless, the issue of collaboration between the civilian and defense sectors is one of the cornerstones of national emergency response, by virtue of each sector’s specialization in terms of experience, technical knowledge and expertise (Maj. Sisk & McLeroy 2008).

For this reason any solution must be able to respect this duality without causing friction between the two government sectors. This is best evident using WHO’s pandemic alert phases created in 2009 for influenza, which describe each pandemic phase and all actions according to each phase. Specifically, WHO introduces a 6-phase timetable, which begins from Phase 1 (no animal to human transmission) to Phase 6 (community level outbreaks in at least one country in another WHO region) (World Health Organization 2009). Phase 4 is the pivotal stage from which an outbreak is deemed a pandemic. Ideally, that’s the timeframe the defense sector should become more actively involved, bearing in mind that in previous phases it retains a purely consulting role.

However, it is of paramount importance for the transition between civilian and defense sector to be as smooth as possible. The fragmentation of the public sector will act as a catalyst fueling people’s panic, who will not be reassured by a failing system, thereby amplifying the effects of a biological attack. After having established clear jurisdictional boundaries and procedural matters for the newly created body, it is vital to ensure that the rest of the institutions accept the new order of things in case of a biological catastrophe. This new body must be politically independent, due to the ever-shifting political landscape that can play a disastrous role in case of an emergency. This charter-ensured independence will allow the new agency to create its own technocratic protocols and perfect all emergency procedures, which must be simple yet broad enough to cover a number of aspects, such as designated hospitals for incoming patients, or gathering points that will allow families to be reunited.

Of course, this new agency must be well-funded in order to ascertain that all supporting personnel is well trained and adequately equipped to handle a natural or a man-made pandemic. Otherwise, an ill-equipped organization subject to the whims of the political elite will only hinder all disaster management efforts.

This proposed agency must be able to cover a variety of functions that relate to communications and coordination, medical treatment, decontamination and render-safe operations, public affairs, crowd management, disease surveillance and evidence gathering, overseeing joint operations with other agencies responsible for the apprehension of all involved individuals and last but not least legal affairs (Falkenrath 2001). The list is by no means exhaustive but represents a starting point.

Legal affairs might seem trivial in the face of an outbreak, but in fact may represent the biggest hurdle for disaster management in democratic societies, because it involves imposing on people restrictions that are considered otherwise illegal. In a simplistic approach after a medium or large-scale biological attack a curfew will be imposed, quarantined areas will be sectioned off, the military will be called on to help in handling the situation, private property may become makeshift hospitals, decontamination procedures will become mandatory, searches for conducting search and seizures will become the new normal and the media will be controlled if not censored.

These actions *might* be permissible for certain government agencies and well within their authority if they are acting under an emergency protocol, but for other agencies a legal dilemma is created: color within the lines or ignore jurisdiction and authority? Both sides present drawbacks. In the former case, following orders precisely may cause innocent people to lose their lives because the system has glaring jurisdictional holes that were not covered by any agency. As such lives fell through the cracks, because bureaucracy dictated restraint. In the latter case, the very fabric of society may be distorted, causing widespread collapse after the crisis is over (Falkenrath 2001).

In the effort to manage a national disaster, the government will trample on basic human rights on the principle "*Salus populi suprema lex*", which roughly translates as "*The health of the people should be the* *supreme law"*. Therefore in the name of saving the nation, sacrifices will be made, which for the most part might be acceptable to the people.

The main question that arises is who will ensure that things will return back to normal once the situation has been dealt with in order to avoid becoming a police state?

Of course it is impossible to predict how individual law-makers will react in a crisis, but this proposed agency must be able to provide a complete legal framework that details the compromise between the government and the people in case of an emergency, which must provide details on jurisdiction and authority boundaries (Falkenrath 2001). Granted, the task at hand is massive in its sheer size and complexity, but in the 21st century the threat of weapons of mass destruction, which include biological weapons, cannot be ignored.

7.2.1.1 The public health system

Without a doubt the national emergency response must include the public health system, which will be the first to be called to action, should a biological attack occur. Due to the fact that it is considered a low-probability scenario, medical personnel are not adequately equipped to handle a pandemic or even large number of patients that may or may not be infected. Consequently the first step towards organizing a better response must be the systematic and comprehensive training of all emergency personnel, from police officers to firemen, who will be called to action.

A health crisis affects a society as a whole, and as such all government agencies must be able to coordinate and collaborate easily, ignoring inter-agency rivalries and conflicting security protocols. A good preparation can even act as a deterrent because a well-protected society, which is equipped to deal with anything, is a hard target that once hit might not yield the desired outcome (Holloway et al. 1997).

Before the attack, the public health system must be prepared by enhancing bioterrorism-related education, which will allow emergency responders to identify easier the threat, producing educational materials informing and reassuring the public that the system can handle everything, stockpiling vaccines and drugs, establishing molecular surveillance in order to analyze suspicious clusters and drug-resistant trains, supporting and developing vaccines, antibiotics and diagnostic tests (Khan, Levitt & Sage 2000).

After an attack happens, though, one of the innate aspects of biological weapons is their incubation period. Contrary to other types of weapons of mass destruction, pathogens may live inside a host completely undetected for days, thereby completely escaping the scrutiny of first responders. This characteristic puts a strain to the public health system preparations, nevertheless the rapidness with which doctors can identify a pathogen can make all the difference in the world, even for asymptomatic patients (Chyba 2001).

The early symptoms of a biological attack should resemble one of the countless diseases doctors encounter on a daily basis, thereby diminishing the chances of correctly identifying an outbreak as intentional, rather that natural. This situation can be partially rectified by properly trained doctors but most importantly by quick dissemination of information. General epidemiological skills such as surveillance methods and diagnostic techniques will be vital in identifying the threat early on (Khan, Levitt & Sage 2000).

One of the main problems of the public health systems as it stands is the nightmarish red tape. If a doctor has suspicions about a certain patient, the she or he should be able to take this matter from the clinic, to the city, national or international level without having to wait for weeks. The same applies for horizontal dissemination, which is essentially among doctors (Lt Col Das & Brig Kataria (ret.) 2010). The reasoning behind this proposition is simple: the faster a health crisis can be identified, the faster the national mechanism can be put into gear and the better chances are for the infected, as an entire nation will put its considerable resources into use (Chyba 2001) (Khan, Levitt & Sage 2000). Establishing communication lines will make tremendous difference in addressing the crisis.

This approach may be problematic, considering that each diagnosis depends largely on the doctor's personal opinion, which might be biased or misinformed. The alternative, though, is walking through the labyrinth that is modern bureaucracy in the hopes that nothing terrible happens in the meantime. As all policy-makers can attest hopes and prayers are only good for election campaigns and definitely not for combating national security threats.

As discussed it is impossible to ignore the psychological impact of a biological attack. Therefore it is imperative that medical personnel are properly trained in order to be able to identify anxiety, depression and disassociation ad as such facilitate "triage, diagnosis, and treatment of those exposed or infected", both for those infected and for those responding to the crisis. (Holloway et al. 1997).

The role of the media should not be ignored. In an era of fake news, where rumors are almost equal to verifiable information, it is of paramount importance to communicate accurate information so as to alleviate excess stress to the society.

7.2.1.2 Preparedness drills

Preparedness drills are the government's way of trying to better prepare the society for a danger; almost every citizen has participated in a drill simulating a natural disaster such as a flood, or an earthquake. The reasoning behind drills is simple: by practicing numerous times in controlled conditions what needs to be done, then in an uncontrolled environment training will prevail over panic, thus minimizing casualties and mayhem. For the most part, these drills are announced and the participants know that they are safe, so as to avoid unnecessary psychological damage.

Each country designs its own drills in a way that makes sense with the security requirements, in what is perceived as "cultural anxiety" (Ochs Dweck 2013). For instance, drills conducted in Israel are a world apart from drills conducted in Central Europe, because after all, why would Switzerland do an earthquake drill? Different objectives are set, and they alone define the public's participation and role in the drill.

Preparedness drills are a vital element of the national security apparatus, which must be able to mobilize not only the defense sector but also the civilian sector. Therefore the objective is commonly two-fold: firstly, the civilian sector is tested in order to ascertain its capacity in contending with a particular threat and secondly, the same sector is called upon to communicate its ability to protect the public (Ochs Dweck 2013).

There are two ways to conduct a preparedness drill: either in the form of a tabletop exercise, which simulates an emergency situation in an informal low-stress environment or in the form of a live-action exercise, which is more often than not, the next step to a tabletop exercise. In the latter case all the participants are mobilized and presented with a scenario. The end result should be an action plan, which details all actions that need to be taken in case the simulated emergency ever occurs (Kuntz et al. 2008).

In the case of biological terrorism, preparedness drills are of utmost importance, because they increase situational awareness in the public. As discussed extensively, bioterrorism actions are "high-impact", in that they are destructive and could cripple the society. Therefore, how else to better prepare the public rather than with preparedness drills that will clearly detail all emergency procedures. The point behind such a drill will be to minimize the psychological impact of the attack, by removing –to a certain extent- panic from the equation, and ensuring streamlining all emergency procedures.

7.2.2 International efforts

As discussed above, biological threats concern the entire international community, because pathogens recognize no borders. As is often the case, the powers that be recognized that the best way forward is the creation of various organizations in an attempt to coordinate all efforts under a single framework.

7.2.2.1 World Health Organization

The most obvious choice for coordinating the international efforts is WHO, a specialized organization dealing with infectious and non-communicable diseases. All Member-States of the United Nations may become WHO members, upon acceptance of its constitution. WHO, as of 2018, counts 194 Member-States, being a truly global institution (World Health Organization 2018).

However, it can be argued that WHO is not properly funded. For the biennium 2018-2019, according to the budget voted in the 70th World Health Assembly (WHA70.5) on the 26th of May 2017, WHO will have access to $ 4.421,4 million, of which only $ 956,9 million come from Member-State contributions.

Undoubtedly, the budget has quadrupled ever since the dawn of the 21st century, but it is noteworthy that the public health situation has deteriorated drastically, not only with regards to the HIV/AIDS epidemic but also due to the Ebola pandemic and the severe influenza outbreak, which are all affected by the massive refugee influx observed in the wider Middle East and in Europe.

WHO relies heavily on Collaborating Centers, located in over 80 Member-States focusing on areas such as nursing, occupational health, communicable diseases, nutrition, mental health, chronic diseases and health technologies (World Health Organization 2014). Their main task, though, is to report possible outbreaks without the intervention of the host government, effectively avoiding all the red tape that is associated with a notification sent to an international organization. Immediately, a problem becomes apparent: there is no sufficient geographic coverage (Chyba 2001).

In an effort to try and resolve some major issues, Health Canada, in collaboration with WHO launched the Global Public Health Intelligence Network (GPHIN), which is according to the official website "*a secure Internet-based multilingual early-warning tool that continuously searches global media sources such as news wires and web sites to identify information about disease outbreaks and other events of* *potential international public health concern*" (World Health Organization 2018a). The idea is simple, yet elegant in a world which relies a lot on the Internet. As such open sources can be used to gather the so called "epidemic intelligence", which mostly relates to communicable diseases, but does not exclude food and water safety. Its most glaring disadvantage though, is precisely its reliance on the Internet, because it is crucial to remember that not every region in the world is connected and that most epidemics occur in the developing world, which for the most part does not have Internet (Chyba 2001).

WHO has established a number of programs, whose number grows annually as systemic holes are identified and then sealed. One of the most important programs is the Global Outbreak Alert and Response Network, which basically provides the framework for collaboration between existing institutions, in coordinating international outbreak responses. As the webpage states, the Network's objectives contribute towards global health security by *focusing on combatting outbreaks, ensuring appropriate technical assistance to affected states and contributing to long-term epidemic preparedness and capacity building* (World Health Organization 2018).

Furthermore, the role of open source intelligence such as famous Internet search engines cannot be underestimated, as users all over the world along with mass media, can keep track of outbreaks. Epidemic intelligence of this kind cannot be dismissed out of hand, and WHO should better integrate it into its monitoring tools.

7.2.2.2 European Centre for Disease Prevention and Control

The European Union, as a power player in international politics could not remain silent on such an important security matter. The EU Health Program ensures "that human health is protected across all policy areas" and works towards eliminating threats both to physical and psychic health. The health program is meant to address not only naturally occurring communicable and non-communicable diseases but also intentionally caused outbreaks.

The current health program spans from 2014-2020 and has been budgeted to € 494, 4 million (European Commission 2014). For comparison purposes, the program for 2003-2008 cost the EU € 312 million (2003/C 62/06) and € 321, 5 million for the period 2008-2013 (2008/170/EC).

However, the European Union's only competence is to support, coordinate or supplement actions of the member states in accordance with ar. 6 of the Treaty of the Functioning of the European Union, and as such its reach is limited by what the Member-States choose to do.

In 2005, the EU decided that it would not be sidelined and established the European Centre for Disease Prevention and Control (ECDC), which aims at strengthening the Union's defenses against 52 infectious diseases, which are monitored closely by ECDC personnel. Its work begins from epidemic intelligence, which includes surveillance, to outbreak response and preparedness.

It becomes obvious, therefore, that the ECDC is attempting to fill the institutional gap that was created inadvertently with the establishment of the freedom of movement. EU territory is regarded as uniform in the eyes of European law, and people, goods, services and capitals are free to move between Member-States. As it has been argued in length, pathogens ignore artificial borders but humans don't. So in order to manage a large population and the biological threats associated, the Member-States created an organization that would facilitate the rapid assessment of risks, the identification and dissemination of good practices and the provision of evidence-based tools and guidelines (ECDC 2018).

The ECDC works closely with EUROPOL, in terms of organizing training workshops and seminars in hopes of increasing bio-risk awareness and mitigation training. (Europol 2018). It also operates on a national level, in close collaboration with the competent national bodies, relating to the same technical field, especially with regards to surveillance, responses to health threats, scientific opinions, scientific and technical assistance, collection of data and identification of emerging health and public information campaigns (ECDC 2018).

The afore-mentioned, though, leave a lot to be desired. In a time when the very nature of the Union is under extreme scrutiny, Member-States are loathe to pivot towards a stronger and more solid EU, but granting it more competencies. Public health was, is and will continue to be considered a national security matter, which outranks all other concerns.

Undoubtedly, the fact that the EU is allocating more funding to its health program signifies an important shift in policy, but that does not mean necessarily that the funds are earmarked to combat biological terrorism, which befalls on national governments. EUROPOL's competence in the area is limited, and for the most part it is treated as a separate threat from terrorism, notwithstanding the fact that a non-state actor is the most plausible candidate for launching a biological attack.

Then, what is to be done if the EU cannot shoulder any more responsibilities because the Member-States do not allow it? First of all, the ECDC must encourage more common training workshops among the Member-States, so that the best practices can be adopted uniformly and fill any potential authority gaps. These workshops must concern not only microbiologists, epidemiologists and intelligence analysts but also emergency personnel that must be training on a European level the same way they are trained on a national level. Secondly, EUROPOL's role must become clearer on the matter and establish direct communication lines with national law enforcement agencies, which will undoubtedly be called to action if a biological attack occurs.

For most policy-makers, education and training rank low in the list of priorities, because they must manage a constellation of problems, most of which can be attributed to the limited funding options: the biggest threat modern societies face today. However, as is often the case, this intensive training will allow emergency responders to remain calm and do what they are trained to do when everything else around them is collapsing. It might seem as an insignificant solution, whose only purpose it to fill pages upon pages of meaningless instruction manuals, but in case of an emergency it is proper training that saves lives and keeps society functioning.

7.2.2.3 INTERPOL

INTERPOL, as its name suggests, is the world's "*largest international police organization*", counting 192 Member-States. Taking into account the rising threat of bioterrorism, INTERPOL works with law enforcement, health, academia and industry in order to effectively deal with this rising international security problem, by working to reduce the threat and establish effective countermeasures (Interpol 2018a).

INTERPOL, with three distinct projects (Project Biosecure, Project Rhino and Project Oleander) focuses on capacity building and training, while with Project Vector is provides national agencies with operational support. The former allows the Bioterrorism Prevention Unit to support Member-States in responding to biological threats and establish effective countermeasures, while the latter hopes to provide stakeholders with the necessary tools to *provide awareness and skill enhancement related to border biosecurity, detecting triggers and indicators of biological hazards and contraband, evidence collection and transport* (Interpol 2018).

By definition, INTERPOL's role is complicated due to the fact that it is a far-reaching transnational agency, which begs the question of accountability since its jurisdiction is not territorially limited. In this case accountability has a two-faced aspect, both internal in terms of the chain command and external which concerns civilian review and parliamentary scrutiny (Sheptycki 2004). Restrictions, though, are placed by its very Constitution which forbids the agency from become involved in political or military operations (ar. 3 INTERPOL Constitution) (Interpol 2018b).

Simply put, it is not a police organization per se in the traditional sense of the word as its aims, as described in ar. 2 of its Constitution, include “*ensuring and promoting the widest possible mutual assistance between all criminal police*” and “*establishing and developing all institutions likely to contribute effectively to the prevention and suppression of ordinary law crimes*” (Interpol 2018b). Further to this it provides a framework for cooperation, so as to increase the investigative capabilities of the Member-States, in the hopes of preventing and solving crimes (Roraima 2007).

It becomes apparent, therefore, that its role is limited in combatting biological terrorism, as the Member-States themselves have not accorded such competences, apart from ensuring dissemination of best practices and periodical training seminars.

For the moment, it is conceived as highly improbable that Member-States will pivot towards INTERPOL, truly making it an international police force, for the sole reason that bioterrorism falls under the umbrella of national security; a sector which has always been considered sacred for governments, as evidenced in the never-ending debate within the framework of the EU. Moreover, even if the stats decided such a massive policy shift, the entire organization would have to be re-designed, due to the fact that a conflict could arise between the prohibition to participate in military actions and the probability of involving the defense sector in case of a large-scale biological attack.

However, INTERPOL’s role needs not be confined within the strict parameters of providing a platform for cooperation. Seeing that it is a global agency, with operational experience and technical know-how, INTERPOL could prove vital in assisting national agencies that deal with the biological threat to modernize their prevention branches, but not in such a way that could cause unnecessary friction with national law enforcement and intelligence agencies.

7.2.3 Amending the Convention

As discussed above, the lack of monitoring system embedded in the 1972 Convention greatly hinders its application. Nevertheless, due to the sensitive nature of weapons control, as it is directly related to state sovereignty and national interests, it is difficult to toe the line between effective control and micromanaging. The very nature of biological weapons signifies that they are adaptable and covert, therefore, what could be done to separate naturally occurring diseases from lethal state-run programs, without causing a political maelstrom in case the result is only a false-positive? History offers a multitude of incidents, which demonstrate that the governments are suspicious and ready to accuse their opponents without corroborating evidence.

In layman's terms, the Convention needs a monitoring mechanism of high positive and negative predictive value, meaning that the mechanism is capable of identifying true positive and negative results, leaving no room for false-positives so as to avoid fuelling suspicions, which in this era can escalate to a bloody conflict (Kadlec, Zelicoff & Vrtis 1997).

Nevertheless, in the framework of biological terrorism, by actors which do not consider themselves bound by any treaties and which have no regard for human lives, would the review of the 1972 Convention have an impact? To put it bluntly, no, why would it? Almost every single piece of technology required to achieve weaponization is dual-use, which is impossible to regulate otherwise the entire economy would collapse, and certain common pathogens can be found in nature.

As discussed extensively, one of the ways for terrorist organizations to acquire biological weapons is to buy some from state actors. Of course, the 1972 Convention prohibits states from developing, producing, stockpiling, acquiring or retaining biological weapons but the text does not specifically refer to non-state actors, since the idea of a violent non-state actor acquiring biological weapons seemed far-fetched.

This gap was filled by the famous Resolution 1540, voted by the UNSC on 2004. The perambulatory clauses begin by highlighting the threat of WMD to international peace and security; reiterating the need to abide by the provisions of the various multilateral treaties –which are not named- aiming to counter the risk of proliferation; expressing concern over the threat of terrorism and the ever-augmenting illicit trafficking. The resolution itself is placed under the infamous Ch. 7 of the UN Charter, which means that it is legally binding, especially when taking into consideration the strong and absolute language used.

According to the resolution "*all States shall refrain from providing any form of support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery*". Additionally, all States were to incorporate into their national legislation various effective provisions to prevent proliferant non-state actors.

In sum, Resolution 1540 aims to strengthen the legal framework against biological weapons, as it expands the prohibitions to non-state actors as well. The problem though remains: the proposed monitoring mechanism which supposedly ensures compliance remains largely untested (Woodward 2007, pp. 108-109).

7.2.4 Intelligence services

Undoubtedly the most important gear in the state prevention-mechanism are intelligence services, and more specifically HUMINT.

As explained above, uncovering a covert biological program, be it state or non-state run is particularly difficult, as all scientific activities leading up to weaponization do not leave any traces and all equipment required is dual-use. Essentially, this hurdle means that there must be people on the ground verifying intelligence coming from alternative sources such as SIGINT (signals intelligence), IMINT (imagery intelligence), even OSINT (open-source intelligence).

History shows that defectors were the most invaluable source of intelligence concerning particularly the Soviet program. On the other hand, history also shows that human sources can be notoriously unreliable, as there are influenced by personal bias.

To take a step back, HUMINT is the oldest form of intelligence gathering and can be either overt, using diplomats and military attachés, or covert using operatives, otherwise called “spies”, a highly sensualized word due to mass media (Johnson 2010). The main element of HUMINT is the ability to gain access to a source to obtain information, and ideally the asset should be able to consistently gain repetitive access, so as to provide “actionable intelligence”, leading to a specific military or civilian action (LTC Dillon 1999).

HUMINT is often considered a remnant of the Cold War, as the two superpowers were locked in their endless game of espionage. As the Soviet Union fell and a new enemy arose, the powers that be started casting doubt on HUMINT, especially when taking into consideration the technology leaps that now allow trillion-dollar-worth satellites to intercept any signal at any given time, anywhere in the world (Lewis 2004). However, the main reason behind this policy shift can be found in the foundations of the American political system and the power of the defense lobby, as political games started dictating security needs.

The pivot towards technologically obtained intelligence started happening with the CIA in the 1970s, during the final stages of the Vietnam war, and was never questioned until 9/11, when the intelligence apparatus failed (Lewis 2004). SIGINT, though, was effective against a superpower with a clear command structure, but its effectiveness is highly questionable against an enemy that that could simply not use a computer or a phone.

But why is HUMINT considered to be, particularly in the case of bioterrorism, such an important weapon? HUMINT basically relies on people's opinion about something and can be invaluable, as the people on the ground can provide a more comprehensive picture of a region –or country's- political, military, social, and economic background, particularly in states where information is highly censored, as is the case in many Asian and Middle-Eastern countries (Lewis 2004). Basically HUMINT conveys the enemy's "intent" (LTC Dillon 1999).

In that sense, HUMINT could be used to penetrate a terror cell, although it is noteworthy that such an operation is extremely dangerous for the asset and notoriously difficult and may require many years before some progress is noted. The reason behind that is that terrorist organizations due to the fact that they are in open war with most of the world, try to operate in secrecy so as to protect both themselves and the cause. Further to this, terror cells have changed their *modus operandi* to be able to keep up with their enemy. Now almost every significant piece of information is highly compartmentalized and suspects ranking low in the hierarchy of the cell do not know the big picture, thereby making the collection of strategic, or even tactical, intelligence extremely difficult. Of course, the only reasonable solution would be to attempt to infiltrate more cells that one, but such an effort requires highly-trained personnel, a lot of man-hours, political capital and actual funding (Lewis 2004).

Part from the operational difficulties associated with clandestine action, the untrustworthiness of recruited assets is considered legendary among intelligence analysts. How can a person motivated by self-interest -often greed- be trusted to produce time-sensitive and good intelligence? Recruiting foreign assets is considered an art-from by intelligence officers, who must find the delicate balance between honor and dishonor, often under less than ideal circumstances. And even after everything is said and done, the asset might prove to be a double-agent, to the detriment of the agency that recruited him or her (Johnson 2010).

In spite of HUMINT's shortcomings, it is ironic how an expensive piece of equipment, such as a drone, cannot penetrate the most rudimentary setups. For instance, most of Al-Qaeda's network was set up in the inaccessible mountains of Afghanistan, inside a vast underground maze of caves. HUMINT had slim chances of getting in, but SIGINT stood no chance.

Lewis (2004) blames the pivot towards technology for the operational shortcomings of HUMINT. If the entire intelligence community hadn't chosen technological means over boots on the ground, then intelligence gathering would have been perfected, and political support –which leads to adequate funding- wouldn't have been withdrawn.

Johnson (2010) seems to agree up to a point, although he highlights the quantity and quality of intelligence produced by HUMINT compared to SIGINT in the eyes of the policy-makers, who were in awe of the sheer power of American satellites, capable of dazzling them with countless photographs, which could be used to justify any action. By contrast, intelligence provided by anonymous sources is not deemed as appealing, although its quality may at times surpass that of SIGINT intelligence.

Margolis (2013) also acknowledges the damaging impact of technological prowess. Particularly in the case of US intelligence, HUMINT has been relegated to the second place, leaving all the data provided by satellites and interceptions unexplained. Capabilities and intentions can serve to corroborate technical intelligence, or even discredit. However, Margolis takes his argument a step further to note that "*no single form of intelligence collection does well by itself*", but the technological fascination might create certain blindspots, especially where HUMINT is needed.

The main argument in favor of HUMINT is the case of Iraq. During the time before the second invasion, all intelligence was based on the allegations of Iraqi defectors, who were attempting to overthrow Saddam Hussein. Later on, inspections showed that the regime had not continued its biological research. The intelligence community was forced into this position for the sole reason that almost all HUMINT operations were halted. Perhaps the Second Gulf War would have been averted, although there is not use debating "what ifs".

However, it is noteworthy that not all forms of intelligence can be applied against all targets, and as such the usefulness of HUMINT over SIGINT must not be exaggerated. There are certain regions of the world, which are best monitored using SIGINT, as was the case of the Soviet Union, or today particularly in cases of extremely isolated societies such as North Korea. Historically, regions with high number of assets on the ground, as was the case of Europe particularly during the Cold War, produced the most "actionable intelligence", so it can be suggested that an active presence is directly correlated to good intelligence, but what if simply peeking behind the curtain is impossible? Additionally, the collection method varies according to the sector. For instance, penetrating the economics sector with HUMINT will most not yield the desirable intelligence, as would be the case with SIGINT (Johnson 2010).

In any case, though, HUMINT plays the primary role in countering biological terrorism, because in the end SIGINT will say what a building looks like and not what's inside. Of course, SIGINT's role must not be underestimated during the Digital Era, we are currently living in. If a cell was attempting to orchestrate a biological attack, either by producing the weapons itself or by buying them ready, it is almost certain that one point or another a phone would be used. That is precisely the moment HUMINT steps is. The technological capabilities of intelligence services cannot be doubted, but an important phone call might be lost in the sheer number of phone calls happening every minute of the day; unless of course there was an asset on the ground narrowing down the search parameters.

For this reason, HUMINT worldwide must be reformed to better respond to reality. SIGINT is updated almost on a daily basis, as technology advances with terrifying rhythms, while HUMINT is lagging behind, buried under red tape. What is to be done?

First and foremost, the number of operations officers must be increased along with the number of official covers, which might protect an asset in danger. Prestige and adequate compensation should be offered in the hopes of preferring quality over quantity of assets. In the same spirit, language skills are deemed of utmost importance, as now the enemy speaks a constellation of disappearing dialects and not the traditional romantic languages, encouraged particularly among Europeans. Furthermore, the very size of bureaucracy which accompanies HUMINT must be reduced so as to facilitate small and flexible teams, ready to spring to action at any given moment, without sacrificing oversight.

At the agency-level, although the network itself is considered highly-protected and coveted and the agencies are spectacularly territorial, discouraging efforts of international cooperation and intelligence sharing. It sounds counterintuitive to share intelligence vital to national security with a foreign agency, but in terms of global threats, global responses are required. Therefore, a systematic transformation of the culture surrounding this covert world is deemed of the utmost importance.

The point is to prevent a large-scale biological attack, which will have catastrophic consequences for society as we know it, and for that reason the afore-mentioned ambitious agenda is justified.

Nevertheless, the question remains: how can intelligence services identify whether or not a person or persons are involved in suspicious activity. Inadvertently, this debate seeps into the territory of ethics, with the dilemma “security vs. liberty” in the forefront. Is mass surveillance justifiable in order to prevent a pandemic? Are human rights the very thing that keeps our societies together and apart from terrorist groups?

8 Conclusion

Bioterrorism is contested by law-makers and academics alike, as based on empirical evidence it is highly unlikely to happen. For this reason, budget decisions mostly reflect this notion and underfund all agencies, whose primary task is to respond in the event of a biological attack. On the other hand, governments in the past decade are steadily increasing spending earmarked for biological preparedness, as the world has stepped into the arena trying to fight a nearly invisible enemy.

Biological terrorism, of course, comes under the umbrella of the "War against Terror" unleashed by the international community with the blessings of the United Nations. Its roots can be found in the state-run programs, which opened the way into biological research and left behind poorly decommissioned facilities or even stockpiles of dangerous pathogens. Non-state programs, therefore, are inspired and rely heavily on technology and know-how acquired during the dark times that humanity was attempting to eradicate itself.

History, fortunately, provides a handful of cases, in which a terrorist organization utilized WMD, and even fewer cases where biological weapons were used. However, that is not to say that the danger is not real, no matter how slim the odds. The odds of a nuclear holocaust were mathematically impossible, and yet the international community during the Cold War braced for impact as the Doomsday Clock slowly ate its way towards midnight. The odds of a domestic attack in the heart of capitalism, two oceans away from the Middle East, were astronomical, yet everything changed when the planes crashed into downtown New York.

Preparing for a danger that may or may not happen seems nonsensical, particularly in the wake of an enormous economic crisis, which drained psychologically and financially the society, leaving it particularly vulnerable. Conversely, law-makers should focus on the fact that if it does occur, the consequences will be catastrophic and the fabric of society will risk crumpling. Forgiveness for an "honest mistake" will be the last thing on everyone's mind, as was the case after 9/11.

It is the responsible choice to prepare for the worst-case scenario, even if it never comes. Preparedness can be therefore divided into two major sectors: prevention and response. Prevention hinges on the work of the international community in implementing effective measures in an attempt to counter horizontal proliferation, along with the intelligence agencies, whose vital work allows for early warning and even stopping an attack from ever happening. Assets on the ground are invaluable in that sense, as their successes may never become known to the general public, which can continue its blissful sleep.

Response rests on the shoulders of state mechanisms, with the occasional help of international agencies specializing in biological emergencies.

In conclusion, this thesis attempted to fill a gap concerned with addressing and mitigating the risk of bioterrorism. The research can be taken a step further to include a more comprehensive policy proposal that would capitalize on existing systemic structures, so as to be appealing to even the most critical of decision-makers.

9 Tables used: Incentives and disincentives

STATES	
INCENTIVES	**DISINCENTIVES**
Potency per kilo of pathogen	**Unpredictability**
Dual-use equipment for production & stockpiling	**No cure for the majority of pathogens**
Covert production	**Possibility of horizontal proliferation**
100% temporary incapacitation and not 100% mortality	**Fear**
Detection relies on unreliable HUMINT	
Cost effective ($/per square kilometer)	
Deterring power	
Fear	

Table presented in Ch. 2.3.

NON-STATE ACTORS WITH POLITICAL GOALS	
INCENTIVES	**DISINCENTIVES**
Not bound by international law	**Indiscriminate nature**
Potency per kilo	**Dependent on public support**
Covert action	**Technological hurdles**
Reload ability	**Silent attack**
Difficult to detect effects	
Fear / Mass hysteria	

Table presented in Ch. 6.3.

NON-STATE ACTORS WITH RELIGIOUS GOALS	
INCENTIVES	**DISINCENTIVES**
Not bound by international law	**Indiscriminate nature**
Bound by religious belief	**Technological hurdles**
Potency per kilo	
Covert action	
Reload ability	
Difficult to detect effects	
Fear / Mass hysteria	

Table presented in Ch. 6.3.

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