no 22

Bioterrorism and Threat Assessment

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THE WEAPONS OF
MASS DESTRUCTION
COMMISSION
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Bioterrorism and Threat Assessment

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Introduction

During the last week of October 2004, newspapers, wire services and Internet sites around the globe ran stories concerning the release of a new British Medical Association report on biological weapons. Many of these stories led with lines such as, “Biological weapons that target selected ethnic groups could become part of the terrorists' arsenal…” and, “The threat from biological weapons has outstripped that from chemical and nuclear arms because of the ‘riotous’ progress of biotechnology.” Such media provides an interesting perspective on the unique challenges associated with efforts to address the threat of bioterrorism.

On the one hand, much of the media’s recent coverage successfully captured the BMA report’s two fundamental theses that: 1) developments in science – and biotechnology, in particular – are making possible disturbing, new opportunities for the weaponization of biological agents and bioterrorism; and 2) without greater focus and commitment by governments around the world, such developments have the potential to rapidly outpace the international community’s ability to respond to and manage associated dangers. On the other hand, the coverage tended to focus on the report’s discussion of worst case bio-attack scenarios and highlight the report’s most dramatic – but least immediately realistic – examples of possible bioterrorism (such as attacks that make use of genetically engineered agents capable of selectively targeting specific ethnic groups). The result of such coverage is that many in the public are left with the correct impression that bioterrorism is a real danger, but also with an incorrect impression concerning the actual scope and nature of the existing threat.

The widespread attention that bioterrorism receives today is both significant and new. Up until the past decade, the prospect of someone other than a state using biological weapons was largely confined to the realm of fiction and a small cadre of biowarfare experts. The use of the toxic chemical sarin by the Japanese cult Aum Shinrikyo in the Tokyo subway system in 1995 drew the attention of both policymakers and counterterrorism experts to the possibility that at least some terrorists and other non-state actors may indeed be willing and able to engage in mass-casualty attacks using unconventional weapons. However, it was only in late 2001, when an as yet unidentified perpetrator sent weapons-grade preparations of *Bacillus anthracis* – the organism that causes anthrax – through the mail, that the world’s citizens became keenly aware of the notion that violent non-state actors might seek to use harmful biological agents in terrorist acts.

The 2001 “anthrax attacks” (as they are widely known) were not by any means the first bioterrorism incidents. In 1984, for instance, the Rajneeshees – a religious cult located in Oregon in the United States – contaminated salad bars with the non-lethal pathogen S*almonella enterotica* serotype Typhimurium causing more than 750 people to fall ill. Occurring as close as they did to the attacks on September 11, however, the anthrax attacks solidified in a dramatic fashion many of the fears that had accompanied earlier revelations about the advanced level of the secret Soviet biological weapons program and the Aum cult’s attempts to develop biological weapons.

The intense media and public interest surrounding the 2001 anthrax attacks had predictable effects. What was already a major security issue in the United States quickly achieved the status of a global threat as policymakers worldwide were galvanized to address the possibility of bioterrorism. Amidst the hype, bioterrorism simulations were run, research quickly funded and vaccine production commenced. One would assume that a thorough understanding of the threat underlies the difficult policy decisions associated with such preventive and response-related measures, which often involve resource limitations and tradeoffs between programs. Yet this has repeatedly been shown not to be the case. At every level – from the local to the national to the international – the approach to countering bioterrorism has often been partial, piecemeal and distorted by political or parochial institutional concerns.

Previous Commission papers have dealt well with general, high-level issues surrounding biological weapons; here we focus on a specific subset of those issues – that relating to non-state actors and biological weapons – and look at the specific policy questions that arise in this context. This paper argues that an accurate and comprehensive assessment of the threat posed by bioterrorism is essential for policymakers working to identify and prioritize opportunities for reducing the global risk of such attacks. The first section of the document seeks to ground the discussion empirically by reviewing the specific nature of bioterrorism, highlighting recognizable trends in its modern history, and

identifying key lessons and developments from the historical record that might signal how bioterrorism will likely manifest itself in the 21st century. The second section of the document begins by considering how threat assessment may be applied practically to bioterrorism, and broadly evaluating the current set of constraints and incentives for bioterrorism, according to this threat assessment framework. The paper concludes by identifying a number of specific "opportunities" policymakers have to reduce the threat of bioterrorism by strengthening the constraints and weakening the incentives identified earlier.

Framing the Problem

The first essential step in assessing any type of threat is to properly define the scope and nature of what is to be assessed. For the purposes of this paper, bioterrorism is defined as *"the use by non-state actors of microorganisms (pathogens) or the products of living organisms (toxins) to inflict harm on a wider population."*

Three important issues with policy relevance flow from this definition:

- First, we avoid the contentious academic and political debates surrounding the nature of "terrorists" and "terrorism" by focusing on the central issue faced by policymakers: the use by non-state actors of biological weapons. Therefore, for present purposes we sacrifice ontological accuracy for policy utility and consider bioterrorism in its broadest possible sense to include acts perpetrated by criminals, insurgents, and violent non-state actors of all stripes, in addition to those perpetrators that can be properly labeled as terrorists. In doing so, it must not forgotten that in the narrower context of terrorism proper the terror aspect is the most important; in other words, the intent of perpetrators is often to cause psychological as well as physical harm to the target society.

- Second, non-state actors will not necessarily use biological weapons only to cause mass death; biological weapons can be used for a variety of other purposes from the strategic to the tactical. Examples include using pathogens to incapacitate a target population (such as the Rajneeshee cult, who only wanted to make local residents too ill to vote in a local election) or to contaminate an area in order to cause economic loss and general social disruption.

- Third, humans are not the only targets of bioterrorism: crops and livestock can be attacked with bio-agents, or can be used to disseminate biological agents to human populations (so-called agro-terrorism), and there is even the potential that microorganisms could be used to attack physical infrastructure, for example by degrading plastics.

The following characteristics of bioterrorism are important for policymakers to be aware of:

- The primary biological agents considered suitable for bioterrorism include:
    - Bacterial organisms, such as those that cause anthrax, plague and tularemia.
    - Viruses, including those that lead to smallpox and ebola.
    - Toxins, including botulinum toxin (derived from a bacterium), ricin (derived from the castor bean plant), and saxitoxin (derived from marine animals). It should be noted that toxins are not alive and cannot multiply – they therefore share several traits associated with chemical agents.[1]

- Biological agents are not biological weapons. Merely possessing biological agents with the theoretical potential to cause harm is insufficient; the toxins or microorganisms need to be "weaponized", i.e. prepared and disseminated effectively to their target. Having a beaker filled with a solution containing *B. anthracis* represents only a minor hazard. On the other hand, drying, milling and inserting the same quantity of *B. anthracis* into a device that can deliver a

[1] Other types of possible biological weapons include the use of fungi and protozoal parasites, although it is doubtful that non-state actors would use these against human beings. Certain fungi may however be used by non-state actors in anti-crop attacks.

fine powder of spores over a large area enables the biological agent to infect large numbers of people. So, the agent must not only be capable of inflicting harm but must also be deliverable to its intended target before it can constitute a weapon of mass destruction.

- The substantial incubation period (1 day to 2 weeks) associated with most biological agents between exposure to the infectious agent and the onset of symptoms is unique among weapons types. This is a double-edged sword. Although it provides a window of opportunity to respond and treat the infection and inoculate vulnerable populations, it also hampers law enforcement efforts by allowing the perpetrators to distance themselves geographically from the site of initial agent release thereby making it easier for them to conceal their identity.

- Biological weapons are also the only weapon type that can actually perpetuate itself and continue causing harm far in excess of the initial amount of agent used. Here a distinction must be drawn between non-contagious (e.g. anthrax and all toxins) and contagious (e.g. plague and smallpox) biological weapons. At least theoretically, highly contagious and lethal pathogens can present an even greater danger than nuclear weapons in that they are not limited to the geographical target area, and can continue to spread indefinitely.

- There can be a substantial difference in how biological weapons are designed for use by state actors and how they might be used by non-state actors. Although much of the data we currently have on biological weapons, for instance on infectivity and mortality rates, is derived from testing by various state militaries, the goals and requirements of non-state actors are likely to be very different from those of the traditional military theater of operations. For example, to have the strategic effect of diminishing enemy capability on the battlefield, the military application of biological weapons might require a uniform, stable aerosol of droplets containing tricothecene mycotoxins, whereas terrorists seeking to cause chaos to an unprotected civilian population may be satisfied with a less effective delivery of a less exotic agent such as ricin.

- Preparedness can make all the difference to the outcome of a bioterrorist attack. Unlike weapons with more immediate effects, such as explosives, there is the possibility to mitigate the effects of a biological attack through measures, including rapid detection, treatment with antibiotics, vaccination and quarantine. One simulation of an anthrax attack conducted by the Center for Nonproliferation Studies, for example, showed that the difference in the ultimate mortality figures between a poorly coordinated and ill-prepared response and a polished and efficient response was 120,000 as opposed to 35,000 deaths.

- The long-term physiological and social consequences of large-scale exposure of some agents are not yet known. Although we have extensive data on the diseases caused by most biological weapons agents, often the unnatural manner in which these agents are delivered results in disease presentations with unexpected symptomology and epidemiology. For instance, until the “anthrax letters” of 2001, most experts discounted the possibility of cross-contamination through the mail.

Threat Assessment

The basic argument presented in this paper is that inadequate threat assessment leads to sub-optimal policy decisions. The following section outlines a basic threat assessment framework for thinking about bioterrorism holistically and introduces some basic tools that can guide policy decisions in each of the framework’s aspects.

The first essential realization is that the threat of bioterrorism cannot be evaluated exclusively in terms of the hazards posed by the various biological agents themselves or in terms of the likelihood of an attack taking place. It is almost trite to say that even the most dangerous pathogen presents little threat in terms of bioterrorism if there is no-one willing or able to use it. Conversely, even the most diabolical actors require a biological agent capable of causing the harm and terror they might seek. So, an initial construction of a bioterrorist threat can be denoted as follows:

BIOTERRORIST THREAT = CONSEQUENCES OF ATTACK * LIKELIHOOD OF ATTACK

Each of these primary elements can be further subdivided as follows:

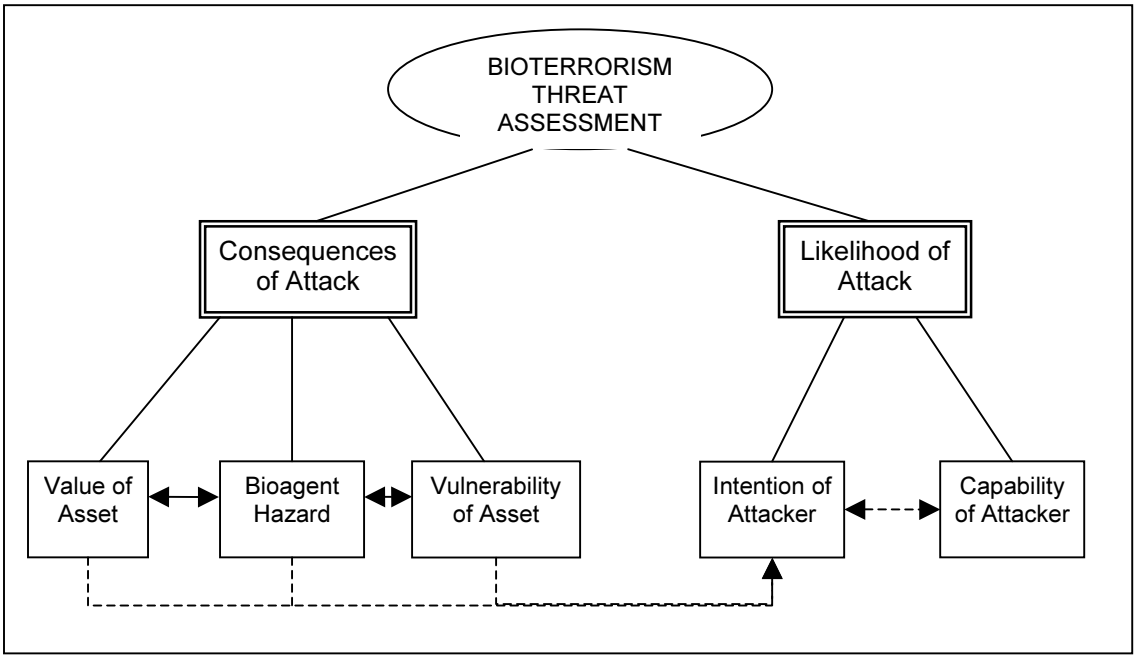
CONSEQUENCES = VALUE OF ASSET BEING DEFENDED * HAZARD POSED BY AGENT(S) * VULNERABILITY OF ASSET BEING DEFENDED

and

LIKELIHOOD OF ATTACK = MOTIVATION * CAPABILITY OF ATTACKER(S)

So we see that the threat of bioterrorism is a function of the interaction between *the value and vulnerability of the asset being defended, the harm potential of the biological agent, and the capabilities and intentions of potential attackers.*

This construction is supported by the results of an interdisciplinary workshop organized by the Center for Nonproliferation Studies on *Bioterrorism Threat Assessment and Risk Management*[2] and is represented below.



Two important points should be noted about the above diagram. First, the various elements do not act independently: the nature of some of these elements can affect and be affected by several others. This is indicated in the diagram by drawing arrows between elements. If we concentrate disproportionately on one or two of the legs, we might miss synergies that can reduce the threat. One obvious example: by reducing the hazard potential of a specific agent through widespread vaccination, we make an attack using that agent less attractive to the terrorists.

Second, the intention of the attacker is dependent not necessarily on objective measures of the value and vulnerability of the target, or the harm potential of specific agents, etc., but rather on the attacker's *subjective perception* of these attributes, which may or may not be close to their objective measures (perception is indicated by dotted arrows in the diagram). Understanding this subtlety can provide additional policy options that otherwise would go unnoticed. For example, it may very well be impossible to reduce the true vulnerability of civilian populations to a specific agent, but it might be much more feasible to attempt to alter the perception of this vulnerability held by terrorists. If terrorists

[2] Raymond A. Zilinskas, *Final Report and Commentary: Bioterrorism Threat Assessment and Risk Management Workshop,* (June 2003), accessed at:

do not perceive a target to be vulnerable, they will desist from attacking it, irrespective of the true level of vulnerability.

In the absence of a structured threat assessment, most of the current discourse surrounding bioterrorism focuses almost solely on the harm potential of biological weapons. Less quantifiable aspects such as the strength of the terrorist's motivation to use such weapons and the psychological vulnerability of various societies to bioterrorism are just as important[3]. Perhaps even more consequential than the de-emphasis of the non-physical effects of bioterrorism is the tendency to infer intention from capability, and vice versa. While these factors certainly influence one another, they must also be considered separately. For instance, one cannot assume that because terrorists hate us and want to attack us, they will necessarily choose biological weapons as the means to do so, even if they desire large numbers of casualties. If policymakers and analysts fixate on the relative ease of obtaining certain biological materials and the harm these agents can cause, this can conceal other important questions such as 'Will a biological weapon fulfill terrorist group X's strategic goals?' or 'Does terrorist X's ideology allow the use of indiscriminate biological contamination?' This partial assessment can result in an over- or under-estimation of the true threat. It is in the independent analysis of terrorist intentions that current U.S. threat assessment concerning WMD terrorism in general falls short, resulting in what John Parrachini has labeled "spending big, but not spending smart."[4]

Assessing the Threat of Bioterrorism

We now proceed to examine each of the threat assessment factors described above in greater detail, highlighting the primary policy-relevant implications and supportive tools associated with each element.

Value of Asset to Defender

In the case of bioterrorism, determining value is fairly straightforward in most cases: the 'assets' are dramatic numbers of civilian lives and can be regarded *ab initio* as being of high enough value to any policymaker to concern himself or herself with countering the threat. However, in circumstances in which human lives are not at stake (for instance in certain cases of agroterrorism or contamination of facilities), the value element warrants discussion – it may turn out that substituting for a different agricultural product or razing a contaminated facility and building a new one may be preferable to expending resources on defending it against biological attack. In either case the determination of value is largely a political decision that can be aided by economic estimates of the monetary worth of the assets (which is commonplace in the insurance industry), but will also include consideration of less quantifiable factors such as the importance of public morale and the symbolic importance of a specific asset.

Harm Potential of Biological Agent

When considering the potential for harm in a bioterrorism threat assessment, it is necessary to know the characteristics of the specific biological agent of concern; if the assessment is non-specific, all agents conceivably available to potential perpetrators should be incorporated. Relevant characteristics include a biological agent's level of communicability, its infectiousness, different routes of infection and the disease symptoms associated with these, the organism or toxin's survivability outside a host, the average incubation period, mean rates of mortality, methods by which the agent can be disseminated, and the susceptibility of the agent to various mitigation efforts such as treatment or prophylaxis. Some of this information may be available from previous disease outbreaks (almost all of them natural in origin), but since the number of past mass-casualty bioterrorism incidents is minimal, data describing the course of disease in a bioterrorism context is often unavailable. One way to compensate for the lack of real-world data is to build mathematical models, so-called epidemiological modeling of potential

[3] This tendency to rely on those metrics that can be relatively more easily measured is exacerbated in democracies, where quantitative indices are often appealed to as an objective arbiter in a highly politicized decision-making process characterized by competing interests and divergent sources of information.

[4] Parachini, John. "Combating Terrorism: Assessing Threats, Risk Management, and Establishing Priorities" Testimony before the House Subcommittee on National Security, Veterans Affairs, and International Relations. (July 26, 2000) available at http://cns/pubs/reports/paraterr.htm , p.2.

bioterrorist events. This can include using mathematical equations to trace the spread of a disease (such as the work of Banks and Castillo-Chavez[5]) or agent-based computational models of epidemics (for example, the research of Epstein et. al.[6]). Such models can allow policymakers to test the outcomes of various policy decisions (such as vaccination or quarantine) against a simulated bioterrorism event, where real-world testing is impossible because, for example, it is infeasible to conduct a large-scale test using live smallpox.

Among the most important (and least prepared for) hazards of any bioterrorist event are the psychological consequences. Biological agents are inherently more frightening than guns and bombs, even when they cause similar casualty levels. There are many reasons for this phenomenon, including a natural human fear of contamination and the invasiveness of many agents, particularly biological organisms. A key anxiety-provoking factor is also the intangible nature of most of these agents, which can lead to both gnawing doubt over whether or not one has been exposed and a sense of powerlessness against an unseen hazard. Psychogenic symptoms are therefore far more likely when facing a bioterrorist attack than one using conventional weapons. An example that displays the potential for psychogenic symptoms occurred on 3 October 2001, when over 1,000 students at several schools in Manila, the Philippines "deluged local clinics with mundane flu-like symptoms"[7] after hearing rumors of bioterrorism that had been disseminated through text-messaging. Previously that same year, the tragic attacks of September 11 involved hijacked airplanes crashing into buildings and resulted in over 3,000 deaths. There were however, almost no "worried well" in the September 11 attacks – an indication of the greater potential for psychogenic symptoms with unconventional weapons, even when the fatality rate is higher with conventional weapons.

The psychological effects of these weapons are often overlooked or underemphasized, resulting in at least two deficiencies in addressing the terrorist use of biological agents. Firstly, the lack of adequate resources being devoted to mental health preparedness planning could lead to response plans unable to deal with much of the likely consequences of the use of these agents. Large numbers of "worried well" can also obstruct an effective response to a bioterrorist incident by unnecessarily demanding treatment and thus diverting medical resources from the treatment of those really exposed. At the very least, medical staff time will be consumed differentiating between the infected and the psychosomatic.[8] Secondly, by definition, one of the goals of terrorists is to instill as much fear as possible within a wider audience than those actually physically targeted. If the psychological effects of bioterrorism are discounted, there will be fewer attempts to mitigate these effects through measures such as pre-event education. Denying terrorists the terror they seek to engender may make the attack less attractive in the first place, but this potential deterrent effect is hardly mentioned. Instead, the constant and misnomered use of the term "weapons of mass destruction" serves only to increase the anxiety of the public and make attacks using biological and other unconventional weapons more attractive to terrorists.

Vulnerability to Biological Weapons

There are several general trends that are increasing international vulnerability to disease, especially intentionally-caused disease, of which bioterrorism is a subcategory. These include: the effects of globalization, which facilitates the rapid movement of persons, animals and products around the globe; the appearance of new pathogens as previously pristine environments are encroached upon by human beings and as our close cohabitation with a variety of animals leads to pathogens jumping the species barrier; concentration of populations in urban centers; the diminishing efficacy of antibiotics and other medications; and fewer people with immunity to diseases for which vaccination regimes have ceased.

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[5] H.T. Banks and Carlos Castillo-Chavez (eds.) *Bioterrorism: Mathematical Modeling Applications in Homeland Security.* Society for Industrial and Applied Mathematics, (2003).

[6] Joshua Epstein, Derek A. T. Cummings, Shubha Chakravarty, Ramesh M. Singa, and Donald S. Burke. *Towards a Containment Strategy for Smallpox Bioterror: An Individual-Based Computational Approach*. Brookings Institution Press. (2004).

[7] Wessely S, Hyams KC, Bartholomew R. "Psychological implications of chemical and biological weapons". *British Medical Journal 323*, (2001), pp. 878-879.

[8] This is equally true in the context of chemical terrorism- in the Tokyo subway attack of 1995, which killed 12 people, over 4,400 of the 5,510 casualties who reported to medical facilities showed no symptoms of nerve agent exposure and were classed as 'worried well'. See Smithson, A and Levy, L. *Ataxia: The Chemical and Biological Terrorism Threat and the US Response.* Stimson Center Report No. 35 (2000), p. 95.

The next step in a threat assessment for bioterrorism is thus to conduct a vulnerability analysis. This involves searching for ways in which the asset (be it a city or a single facility) can be attacked by non-state actors using biological weapons. The narrower the scope of a vulnerability analysis the more tractable it becomes, since the range of possible attacks against large populations quickly becomes unmanageable. While a vulnerability analysis may not indicate to decision-makers the most likely targets of bioterrorism, it may reduce the set of possible targets by excluding those targets and attack sets that exhibit very low levels of vulnerability. One threat assessment tool that has been used to assess vulnerabilities to bioterrorism is systems analysis, whereby analysts map out a system (such as the food supply, or an urban educational setting) and use techniques such as fault tree analysis to identify nodes that are most vulnerable to a biological weapons attack.[9]

Capability to Conduct a Bioterrorist Attack

While the discussion of terrorist capabilities for conventional terrorism centers mainly on such factors as a group's training, financing, and communications capabilities (with most analysts taking for granted that terrorists have access to a variety of small arms and explosives), in the context of bioterrorism the focus is squarely on the weapons themselves and the terrorists' capacity for acquiring and using them.

Regarding the capability of terrorists to engage in mass-casualty biological attack[10], several authors contend that previous technical obstacles to obtaining or developing biological weapons have eroded, and that a biological weapons capability is most likely within the reach of at least a certain subset of terrorist groups. The group most commonly cited as being likely to "overcome the technical, organizational and logistical obstacles to WMD"[11] is the al-Qa`ida network, which is reported to be pursuing several types of WMD, including biological weapons. Other commentators are more sanguine about current terrorist capabilities, believing that they have been exaggerated and that technical hurdles still prevent terrorists from engaging in anything more than small to medium-sized attacks using biological weapons (which would not constitute true WMD events). For example, at the more conservative end of the spectrum, a renowned expert like Donald Henderson believes that it is unlikely that more than a few terrorist groups would be able to succeed in procuring any of the agents of highest concern in a form that could be dispensed by aerosol in a manner that would result in mass casualties.[12] Yet even the most conservative of these authors do not unequivocally dismiss the prospect of a group currently (or in the near future) being able to field a biological weapon. Indeed, the only discernible area of agreement between analysts seems to be that there exists at least a minimal possibility of a technologically and organizationally adept terrorist organization succeeding in acquiring a biological weapon capable of causing mass casualties.

One remarkable feature within the broader discussion about terrorist capabilities for bioterrorism is that hardly any of those who believe terrorists currently lack this capacity mention anything about future developments. If recent trends in terrorism have taught us anything, it is that terrorists are nimble, highly adaptive actors who can be innovative when necessary. Terrorist capabilities in general display an upward trend and one must bear in mind that even though a terrorist group's ideology may seem in the eyes of their opponents to be archaic and obscurantist, this does not mean that the group lacks a solid grasp of the most modern technology. At the same time, general advances in several areas of biotechnology and the rapid commercialization and diffusion of this technology mean that equipment and techniques that once resided within the sole purview of a state's military apparatus (such as the ability to synthesize complex chemicals or identify single nucleotide polymorphisms) can now be found in off-the-shelf commercial applications. One of the negative externalities of this technological dynamism is the opportunities it can provide for malefactors. Consequently, even if terrorist groups may lack the capability to engage in bioterrorist attacks today, it is necessary to consider the prospects

[9] See, for example, Bruce K. Hope. "A Risk Assessment Perspective on Bioterrorist Threats to the U.S. Food Supply". [submitted to *Human Health and Ecological Risk Assessment*] (September 2001).

[10] It must not be forgotten that even small-scale or minimally effective bioterrorist attacks can have large psychological and social effects, which may be all that is desired by some terrorist groups. As Cordesman maintains, "As is the case with chemical and biological weapons, public and world perceptions of the impact of such [nuclear] attacks would initially be based on *the fact that they occurred at all*." [Emphasis added] Anthony H. Cordesman, "Defending America: Asymmetric and Terrorist Attacks with Radiological and Nuclear Weapons," Center for Strategic and International Studies (September 23, 2001), p. 22.

[11] Steven Simon and Daniel Benjamin, "America and the New terrorism," *Survival* 42:1 (Spring 2000), p. 8.

[12] Donald A. Henderson, "The Looming Threat of Bioterrorism," *Science* 283:406 (February 26, 1999), p. 7.

for them gaining this capability in the future, with special attention paid to both the direction and pace of change. We have thus highlighted an examination of the rate of change of terrorist capabilities for bioterrorism (i.e., are terrorists likely to acquire these capabilities within five years? Or fifteen? Or fifty?) as an urgent research need.

The following briefly outlines the major requisites for terrorists gaining a biological weapons capability, together with the extent to which current groups are estimated to be able to fulfill these requirements:

a) Organizational Capabilities: An undertaking requiring the technical and tactical sophistication and relatively long planning horizon associated with the use of a large-scale biological weapon would most likely involve a group with more than a handful of members, one in which there is some form of central leadership which can coordinate weapons development and/or acquisition, as well as one that will exercise the requisite control for the maintenance of secrecy. Only disciplined, focused groups which are "vertically organized, highly integrated and ideologically uniform"[13] would appear to have the capacity to initiate and maintain in secrecy a large volume production line for biological weapons agents.

b) Financial Resources: One of the most often cited requirements for a bioterrorist capability is a large source of funding to procure materials and equipment and provide training, facilities, and/or payment for personnel involved in the project. Some regard these needs as beyond the grasp of most non-state actors but this is not necessarily the case, since it is estimated that developing a biological weapon could cost less than a few hundred thousand dollars. Substantial financial resources may have been key factors in enabling both Aum and al-Qa`ida to pursue multiple weapon types, set up front companies and work around technical difficulties. However, finances are not everything - it appears that a certain level of finances is a necessary but not sufficient condition for developing a biological weapon: Aum Shinrikyo possessed assets valued somewhere between $300 million to $1 billion and still failed to develop a viable biological weapon. In addition to the al-Qa`ida network, there are today several terrorist groups with sufficiently deep pockets to facilitate the initiation and maintenance of a biological weapons program, should they so desire.

c) Logistical Resources: Merely having technical expertise, good management and copious funding is probably insufficient to succeed in a biological attack. A group's activities need to be supported by an efficient logistical backbone including adequate transportation and communications. A particular need in this regard is a relatively safe haven where development efforts can take place unhindered, or at least a location where these efforts can proceed with little chance of detection. Unfortunately, it is possible to maintain a small-scale production of biological agents in an area as small as a sizeable basement. If production continued long enough, sufficiently large quantities of agent could be produced. An important, if somewhat less tangible, asset in any terrorist biological weapons endeavor would be a robust and preferably transnational network for acquiring raw materials and equipment, as well as transporting the completed weapon to its destination. Several modern terrorist groupings, including the al-Qa`ida network, would be able to fulfill the above logistical criteria. In fact, al-Qa`ida reportedly maintained biological weapons-related facilities in Afghanistan prior to the U.S. invasion in 2001, and the Aum Shiunrikyo cult managed to operate a state-of-the-art, secret laboratory at the base of Mount Fuji. While indicators for a small-scale, basic biological program are minimal, as the scale and sophistication of the production increases so do the number of observable indicators. In fact many groups and individuals within the U.S. who tried to develop biological agents or weapons have been infiltrated by the FBI and other law enforcement agencies.

d) Knowledge/Skill Acquisition: The technical knowledge and skills required to produce and deploy a large-scale biological weapon can be obtained from two types of sources: i) the indigenous development of knowledge and skills within the group; and ii) obtaining the necessary skills by utilizing personnel from outside the group. Whichever route a group takes to acquire the relevant knowledge/skill set, it must be borne in mind that technological learning consists of the transfer of both *explicit knowledge* (that which can be written down in textbooks, manuals, and so forth) as well as the equally important transfer of *tacit knowledge* (which comes from experience, or face-to-face practical instruction). This is related, but not quite identical, to acknowledging the major difference between theoretical weapons knowledge and practical engineering skill, for without the latter the former are all

[13] Jean Pascal Zanders. "Assessing the Risk of Chemical and Biological Weapons Proliferation to Terrorists" *The Nonproliferation Review* Vol. 6, No. 4 (Fall 1999), p. 30.

but useless to a terrorist group. In certain cases, even a skilled person who has not had experience in weapons development will face a learning curve in transcending these barriers.

There are now a multiplicity of educational resources by which terrorists can educate themselves on aspects of biological weapons, including college textbooks, academic journals, industry publications, and the Internet, and that they can thereby place themselves higher along the learning curve than terrorists from previous decades. The Internet is often cited as an important resource for terrorists. The Internet can, however, prove to be a double-edged sword in that: i) it does not usually facilitate the transfer of tacit knowledge; and ii) it is far from being completely reliable. Besides this plethora of open-source materials, many potential terrorists could acquire knowledge and skills through legitimate programs of higher education.

Terrorist groups with dogmatic, charismatic leaders who exercise methods of social conditioning (such as religious cults) are among the groups often characterized as most likely to engage in WMD terrorism. Yet it is these very groups that may inherently be poorly equipped to maintain the scientific expertise they desire. Even if initial recruitment efforts elicit a talented crop of new members, the conditioning and indoctrination methods these groups often employ are far from conducive to successful scientific work. In the case of Aum Shinrikyo, a paranoid atmosphere that included such practices as sleep deprivation and the use of narcotics may well have inhibited their capability to develop a successful biological weapons capability (although they did succeed in producing sarin and other chemical agents). The other option of course, is to acquire the services of scientists and technicians who have worked on biological weapons programs in the past. In terms of recruiting or hiring the services of personnel formerly employed by state-level weapons programs, there has been much talk about the desperate need or mercenary bent of scientists in the weapons programs of the Former Soviet Union, South Africa and Iraq. It has been asserted that one competent microbiologist (to produce the deadly pathogen) and an experimental physicist or mechanical engineer (to work on aerosol delivery) could be sufficient to create a working biological weapon.[14]

e) Materials and Technology Acquisition: The material requirements for a biological weapon include a seed stock of the desired pathogen, easily-available growth media, and equipment such as a fermenter or lyophilizer. Much depends on the scale of production and the organism being produced. Standard commercial or laboratory equipment can be sufficient for some agents and small-scale production, whereas to quickly create large amounts of agent or apply special processes such as micro-encapsulation, more specialized equipment is required.

The following are possible sources of seed stocks: 1) **the natural environment**: many harmful microorganisms are endemic across wide areas and can be collected directly from the soil or from infected animals. The drawbacks of this method include the difficulty of isolating the organism from the sample and ensuring a sufficiently virulent strain for the purposes of a biological weapon; 2) **purchasing seed stocks from a culture collection**: while culture collections in the United States now have stricter controls (after Larry Wayne Harris, an individual with dubious motives, purchased *Yersinia pestis* (plague-causing organisms) in 1995), many collections in other countries lack even basic controls. Moreover, by setting up front companies, terrorist groups such as Aum Shinrikyo have succeeded in "legitimately" purchasing dangerous pathogens; 3) **theft of seed stocks** from hospital, university, or commercial laboratories; 4) **transfer of seed stocks from a state-level biological weapons program**: while this avenue implies greater risks for all parties, it could enable terrorists to obtain more advanced biological weapons agents, such as organisms cultured for antibiotic resistance; 5) **creation of pathogen from genetic building blocks**: although this has recently become at least a theoretical possibility, it is extremely doubtful that any terrorist group currently possesses the requisite technology or expertise. However, with many Soviet-era bioweaponeers apparently looking for work and the inevitable diffusion of technology, this possibility may not remain quite so remote in the future.

f) Production: Once the biological seed stock has been acquired, the next steps are to grow the organisms in bulk. While simply culturing microorganisms is a fairly straightforward process, there are a number of additional requirements that make producing pathogens for weapons purposes somewhat

[14] Richard A. Falkenrath, Robert D. Newman, and Bradley A. Thayer. *America's Achilles Heel: Nuclear, Biological, and chemical terrorism and covert attack*. Cambridge, MA: MIT Press, 1998, p.112. The authors admit (p.98) that the aerosols thus produced might be less than optimally efficient, but would be nonetheless deadly.

trickier. These include culturing the organism without losing any of its virulence or infectivity factors, and storing it safely and reliably until the following stage of weapon development. Since terrorists will be dealing with highly pathogenic organisms, there is obviously the matter of personnel safety. It is also at this stage that any alterations to the organism (for example genetic manipulation to increase infectivity) would need to take place.

Well-understood, relatively hardy organisms should present little trouble for a skilled microbiologist to produce in bulk (especially if agent purity is not too much of a concern, as would likely be the case in the context of a non-state actor program). However, the expertise and equipment needed vary according to the type of agent produced. Advanced techniques such as genetic manipulation are felt to be beyond the capabilities – or even the desire, since natural pathogens are mostly sufficiently harmful for terrorist purposes – of most groups. However, as biotechnology improves and existing techniques become more widely known, terrorists may be able to produce more advanced weapons agents, especially if they have access to the expertise of former Soviet bioweaponeers who successfully developed many of these techniques.

g) Weaponization and Delivery: While it may be accurate to state that "a few hundred kilograms of a properly weaponized bacterial agent, when dried and milled to a precise particle size, has the potential to wipe out the inhabitants of an entire city,"[15] the devil, as they say, is in the details. In other words, the effect of a biological attack is determined to a large extent by how well the agent has been weaponized. The most effective way to deliver biological agents is in the form of an aerosol, which is a suspension of microscopic particles or droplets in the air. Biological agents can be dispersed in aerosol form, usually by means of some type of spray device, either as a fine powder (solid particles) or as a liquid slurry, although the powder form is considered to constitute a more effective weapon. The conversion of bulk biological agent into an aerosolizable solid is believed by most observers to be a technically demanding task, although the envelopes laced with *Bacillus anthracis* sent through the mail in 2001 confirmed that the production of aerosolizable spores is at least feasible by a technically proficient terrorist or terrorists. If a dry aerosol is not attainable, terrorists could always substitute the less efficient liquid slurry.

Dispersal also presents a number of difficulties, since sunlight, oxidation, air pollution, humidity and other environmental and meteorological phenomena can deactivate many biological agents before they reach their targets. Alternative modes of delivery include contaminating food or water supplies and even spreading a contagious agent through physical contact by inoculating a terrorist and then having him infect others. Testing of agents can be risky in terms of exposure of the group's endeavor, but this is not absolutely necessary if a group is willing to accept some degree of uncertainty.

While neither Iraqi biological weapons scientists nor Aum Shinrikyo succeeded in weaponizing biological agents successfully, aerosol technology is constantly improving and becoming commercialized, which could enable future exploitation of this delivery method. If a group decides that aerosol delivery is beyond its grasp and settles on using a biological agent as a contaminant, there are still significant obstacles. Many researchers have found that large-scale contamination of water or food supplies would be more difficult or less effective than most people realize. More modest contamination (e.g., of a single water reservoir or facility) by non-state actors is certainly possible, but it would be unlikely to result in sufficiently large numbers of casualties to constitute a WMD.

h) The Issue of State Sponsorship: States have a long history of creating, supporting, manipulating, and directing insurgent and other violent non-state groups in order to further their regime's foreign or domestic policy interests. Many of the same states with a history of providing logistical, moral and financial support to terrorists are also those that are suspected or known to have dabbled with biological weapons. A matter of grave concern to many analysts is the possibility of state support for terrorism extending into the realm of unconventional weapons. This envisaged support could range from logistical and technical assistance for a terrorist group's own biological weapons program, to the worst-case scenario in which a state bestows upon its terrorist proxies a working weapon. Needless to say, such a move would vitiate many (if not all) of the requirements discussed above.

[15] Benjamin Cole and Nadine Gurr. *The New Face of Terrorism: Threats from Weapons of Mass Destruction*. London, New York: I.B. Tauris, 2002, p. 53.

One school of thought believes this eventuality to be highly improbable, adducing the consequences for the sponsor in terms of both the targeted state's retribution and international opprobrium, together with the fact that most states would be reluctant to place control of such powerful weapons in the hands of a non-state group, no matter how strong the ideological ties between them. The second school of thought counters that in cases in which leaders feel a sense of desperation, or if they believed they could conceal their contribution, then some degree of assistance to terrorists with obtaining a WMD capability would be possible. Certain biological agents by their very nature make a determination of their origins extremely difficult. Prudence therefore dictates, at least in the cases of state sponsors of terrorism which are known or suspected of involvement with biological weapons, that this possibility should be considered.

Motivations for Engaging In Bioterrorism

In order for the likelihood of a bioterrorism attack to be significant, terrorists must be both capable of conducting a biological attack and motivated to do so. A variety of ideological, strategic and tactical factors provide important motivational incentives and constraints, which shape the inclination of terrorists toward or away from such action. This section outlines those factors that should be considered in any systematic bioterrorism threat assessment.

Ideological Motivational Factors. Ideological motivational factors are those main factors that frame the basic set of political, social, cultural and/or religious beliefs that members of a particular terrorist group hold. In a rudimentary sense, these factors frame what a group is "for" and what it is "against." Any assessment of such factors involves analysis of: general group attitudes and orientations; the substance of its espoused doctrines; and the near unconscious set of values and behavioral precepts – the *norms* – that group members have absorbed through their national, cultural and extremist associations.

Incentives

- *Achieves goals in an ideologically consistent manner.* Certain groups may perceive biological weapons to be uniquely well suited for achieving particular ends in an ideologically consistent fashion. Apocalyptic groups, for example, might consider biological agents a divine or natural tool for bringing about the end of the world. Racist groups might believe that certain pathogens can be used to selectively target specific populations. And still other extremist groups might seek to conduct bioattacks simply because the "WMD" label associated with biological weapons holds out the promise of extreme, mass consequences.

- *Enhances status.* In that WMD have been possessed historically near exclusively by state actors, some terrorist groups might seek a biological weapons capability mainly as a symbol of power and status. Aum leaders, for example, considered their organization a government and military in waiting. Acquiring and using biological weapons was seen by them as a rational step in the organization's development.

Constraints

- *Runs counter to group norms.* Despite the conscious decision made by all terrorists to use violence as a tool to influence others, few terrorist organizations advocate the level of mass, indiscriminate violence associated with WMD. Many terrorist groups might be expected to reject bioterrorism simply because of its reputation for potentially causing catastrophic, unmanageable consequences.

Strategic Motivational Factors. Strategic motivational factors are largely concerned with the particular political, social, or religious goals and objectives a terrorist group has established. They concern what a group seeks to achieve and how it intends to accomplish such ends.

Incentives

- *Causes specific outcomes.* Terrorists may pursue biological weapons because they believe bioattacks have the ability to produce specific outcomes. For obvious reasons, the results most terrorist groups are likely to seek from bioterrorism are: 1) mass casualties; 2) economic

damage; 3) target contamination; 4) strategic function interruption – for example, disrupting an essential service such as transportation by targeting key transit nodes; 5) facilitation of terrorism proper by using a bioattacks to generate publicity, foster fear, and undermine public confidence in government officials; or 6) a combination of the proceeding.

- *Serves as a strong blackmail tool.* Given the particularly strong public fears associated with biological attacks, some terrorist groups might seek a biological weapons capability primarily to leverage the threat of its use as a negotiating tactic.

- *Helps build the organization.* Terrorists seeking to strengthen the image and status of their organization vis-à-vis other groups, might conduct bioterrorism attacks, specifically because so few attacks have been done to date.

Constraints

- *Perceived as counter-productive.* Many groups will continue to avoid crossing the bioterrorism threshold because they are concerned about alienating the sympathies of their proclaimed constituents or their potential international supporters. They may also be wary of the potential "massive" reprisals that a bioterrorism attack would likely invite from any affected state. Finally, given the contentious nature of attacks involving biological agents, some groups may forgo such tactics simply to avoid possible internal dissention.

- *Opposed by state-sponsors.* For a variety of reasons – including fear of repercussions, awareness of the international stigma associated with biological weapons, and concerns about their inability to control the effects of a bioterror attack – state-sponsors of terrorism are likely to apply pressure on those groups they support not to employ biological weapons.

Tactical Motivational Factors. Tactical motivational factors directly concern the methods and techniques that a group employs to achieve its objectives.

Incentives

- *Exploits perceived target weaknesses.* Accurate or not, a large amount of bioterrorism related media has emphasized the vulnerability of modern society to biological attack. Such information likely encourages terrorists to consider bioterrorism as an asymmetric attack that takes advantage of their enemies' particular weaknesses.

- *Facilitates covert development and use.* As discussed previously, biological weapons are extremely well suited for covert development and deployment. Terrorists interested in maintaining secrecy for instrumental or operational reasons will often find bioterrorism a particularly attractive option.

- *Makes use of dual-use technologies.* Most equipment needed for the development of biological weapons is dual-use and can be easily acquired for justifiable purposes. Groups seeking a WMD capability may choose to pursue biological weapons because of the relative ease with which biological weapons production facilities can be established and because of the low security profile such facilities can maintain.

- *Mimics previous attacks.* Some terrorists may seek to engage in bioterrorism simply because they are aware of previous successful or unsuccessful bioattacks.

- *Meets idiosyncratic needs.* Some terrorists may pursue biological weapons largely because they are driven by a personal, idiosyncratic fascination regarding a specific weapon (or agent). Aum's leader Shoko Asahara, for example, is known to have been obsessed with sarin to the extent that he wrote songs about it.

Constraints

- *Perceived challenges of development and use are high.* As discussed in the proceeding capabilities section, the development of biological weapons is not easy. Terrorists are likely to encounter significant hurdles in each phase of development (namely, agent acquisition, bulk production, and weaponization and dispersal). Several particular concerns – including technical difficulties, cost and dangers associated with agent handling – might lead terrorists to believe that the challenges associated with biological agents outweigh their advantages.

- *Unpredictability of outcome.* Numerous factors – including a lack of historical precedents, impossible to control variables such as weather, atmospheric pressure and population movements, and possible effective response efforts – make bioterrorism extremely unpredictable.

- *Better conventional alternatives.* Conventional terrorist weapons such as military grade explosives are likely to do far more damage, both to human beings and to property, than primitive biological attacks in which low-grade toxic materials are used or higher-grade materials are improperly disseminated. Why, in the final analysis, should terrorist groups risk experimenting with dangerous, new-fangled substances instead of relying upon the tried and true conventional methods of destruction that they are already intimately familiar with? As long as these methods continue to be effective, there will be little incentive for most such organizations to adopt more exotic and unpredictable techniques or technologies.

Tools to assess bioterrorist capabilities and motivations: As mentioned previously, the assessment of potential perpetrators' capabilities and (especially) motivations for engaging in bioterrorism, has often been given insufficient attention in threat assessments. Although there are likely to be few external indicators of a non-state biological weapons program, law enforcement and intelligence analysts should remain alert for those indicators that might appear (for instance, group members becoming ill with rare diseases or evidence of acquisition of dangerous pathogens). However, it is primarily by examining general characteristics and patterns of behavior of non-state actors that analysts will be able to discern their capability or motivation for bioterrorism. Several indicator- and behavior-based tools are currently being developed to assess group capability and motivation for engaging in particular kinds of attacks, which include examining such factors as a non-state actor's ideology, past attack modalities, technological level, inter-group dynamics, risk perception, strategic alliances and perceptual biases, among others.[16] Policymakers should encourage such efforts, which although far from infallible, can make an important contribution to the overall assessment of the bioterrorist threat.

Recommendations

Based on the specific nature of the existing bioterrorism threat, the WMDC might consider the following policy recommendations when drafting its final report. These recommendations are those that focus specifically on matters that are well suited to global consideration and international cooperation.

1. **Foster a common, accurate understanding of "bioterrorism."** An important obstacle hindering the development and implementation of more effective national and international bioterrorism policies is the lack of a more widely-shared, accurate understanding of the threat. While experts will inevitably have differences of opinion regarding the specifics of bioterrorism, the following overarching aspects of bioterrorism can be emphasized with accuracy and general agreement, and can be used to broadly frame related policy discussions:

    - Bioterrorism is a "distinct" issue. For a variety of historical and practical reasons, issues relating to biological and chemical (as well as nuclear and radiological)

[16] The WMD Terrorism Research Program at the Center for Nonproliferation Studies has conducted research in the area of assessing non-state actors' motivations and capability. For examples of these techniques, see Gary Ackerman, "Beyond Arson? A Threat Assessment of the Earth Liberation Front" *Terrorism and Political Violence*, Volume 15, Number 4 (Winter 2004) and Gary Ackerman, Jeffrey Bale, Kevin Moran et. al. "Assessing Terrorist Motivations for Attacking Critical Infrastructure" *Center for Nonproliferation Studies* (Final report delivered August 2004).

weapons are often firmly linked in public and policy mind-sets. In reality, a majority of bioterrorism policy issues – from prevention to response – differ significantly from those relating to other types of terrorism using unconventional weapons. Given the unique, highly specialized nature of the problem, bioterrorism should be identified as a distinct issue, which merits focused policy attention above and beyond that given to WMD terrorism writ large or to state-level biological weapons issues.

- Bioterrorism should be understood "comprehensively." Public discussions of bioterrorism are frequently limited to considerations of the threat as it directly relates to the potential of human casualties. Inordinate emphasis on this single – albeit critical – aspect of bioterrorism can inadvertently cause other important aspects of the problem to be eclipsed and dealt with insufficiently. To adequately address the full range of ways in which terrorists might seek to use biological agents, policymakers should be careful to consider the threat comprehensively. It should be remembered that: i) biological agents can be used to attack humans, animals and plants; ii) biological agents can be used to kill, incapacitate and contaminate targets; and iii) biological agents can be employed by terrorists seeking to achieve a wide variety of outcomes other than mass casualties – outcomes such as widespread fear, economic disruption, and enhanced organizational prestige.

- Bioterrorism should be presented "realistically." Public understanding of bioterrorism is frequently distorted by undue emphasis placed on worst case scenarios and highly dramatic – but relatively improbable – potential bio-attack outcomes. While such examples are sometimes important to "shock" broader communities into action, or to provide perspective on the extent of the risks posed by bioterrorism, unbalanced gravitation toward such extreme portrayals of the threat can: i) exacerbate the potential psychosocial impact of actual bioterrorism attacks; ii) strengthen terrorist interest in seeking such capabilities; and iii) subtly skew efforts to address bioterrorism, causing policy priorities to become misaligned with the most important and immediate needs. One especially good method for placing the threat of bioterrorism in perspective is grounding any discussion of the issue in the context of comparable public health issues, thereby clarifying the risks of bioterrorism relative to other natural biological risks that are more commonly accepted and understood.

- Bioterrorism should be understood "flexibly." Science and nature are dynamic forces that regularly produce the unexpected. Especially now as genetic engineering and recombinant DNA technology are making possible in the biological sciences what was recently inconceivable, the concept of bioterrorism should be kept deliberately flexible so that it can be adapted as appropriate to address major changes in the nature of the threat. Today, for example, bioterrorism principally concerns terrorist use of biological agents to affect living targets (humans, animals and plants). It is conceivable, however, that at some point in the future an organism might be discovered or created that could be used by terrorists to effectively attack and degrade specific types of inorganic matter as well.

2. **Strengthen global norms against biological weapons.** It has been noted that "biological weapons have come to be regarded with almost unique opprobrium by the international community."[17] This near universal abhorrence of "weaponizing" biology strengthens key motivational constraints that might dissuade many terrorists from conducting biological attacks. Indeed, the stronger and more unified the global community is in its rejection of such tactics, the more likely that bio-attacks will be: i) seen by terrorists as inconsistent with internal group norms; ii) perceived by terrorists as politically and tactically counter-productive; and iii) aggressively opposed by state-sponsors of terrorism. Many of the world's international organizations are especially well positioned to reinforce and advance global norms through their treaty mechanisms and their public functions as forums for demonstrating international cooperation. In the context of bioterrorism, even when differences of opinion exist between nations concerning the specific mechanisms of cooperation, international efforts should

[17] Falkenrath, et al., p. 16.

consciously and consistently emphasize the fundamental agreement among all states that "the use of biological agents as a weapon by any actor is unacceptable."

3. **Enhance and standardize international biosecurity efforts.** Although terrorists might obtain the seed stock needed for a biological attack capability through a variety of different routes, institutions that maintain dangerous pathogens for legitimate uses – such as culture collections, academic and commercial research labs, and medical facilities – arguably offer the most direct and reliable routes for acquisition. Hundreds, if not thousands, of such facilities exist around the globe, many of which are minimally secured and regulated. Two important biosecurity measures that could be taken by the international community to better safeguard such stocks include:

    - Create an agreed upon a bioterrorism "high-priority agents" list. Various biological agents are widely recognized as posing high bioterrorism risks because of their virulence, effects on health, infectiousness, hardiness and potential to cause public panic and social disruption. A variety of different lists are presently maintained by various nations and international organizations to identify pathogens of concern to specific communities. Only a handful of these might be considered sufficient for addressing bioterrorism in any comprehensive fashion. The establishment of a single, widely accepted "high-priority agents" list – perhaps maintained in the context of a biosecurity convention – would aid in focusing national and international policy attention on the full-spectrum of human, animal and plant pathogens that should be addressed in the context of terrorism. (The Australia Group's biological agent list and animal and plant pathogen lists might serve as a particularly good starting point.) Any such list would need to be regularly reviewed and adapted to account for emerging diseases and changes in science and medicine.

    - Establish an international biosecurity convention. To enhance protection of high-priority biological agents the international community should work to establish a new biosecurity convention that sets clear legal and political obligations for the safe and secure storage, transfer and use of dangerous pathogens. One specific proposal for such a convention, for example, calls for: listing and registration systems for identifying and tracking agents of potential concern; the establishment of international standards for accounting for and securing listed pathogens and toxins; coordinated national import and export regulations relating to listed agents; and, cooperative procedures to aid member-states in meeting their obligations.[18]

    Additionally, Aum Shinrikyo's 1993 efforts to obtain samples of the Ebola virus from Zaire suggest that the international community should remain aware that terrorists might seek to exploit natural occurrences of certain diseases to obtain seed stock for developing potential bioweapons. International and national response efforts that manage outbreaks of certain high-priority diseases should be adequately informed about, appropriately mindful of and sufficiently prepared to deal with biosecurity issues relating to terrorism, even in hot zones.

4. **Support multilateral nonproliferation initiatives.** Most multilateral nonproliferation efforts that seek to control biological weapons – in particular the 1925 Geneva Protocol, the 1972 Biological and Toxin Weapons Convention, and the establishment of the Australia Group in 1984[19] – focus almost exclusively on regulating the use, possession, acquisition or development of biological weapons by states. These efforts are neither specifically designed nor well-tooled to address the emerging challenges posed by bioterrorism. Their importance to the issue, however, should not be dismissed as they play three key roles in minimizing the threat of bioterrorism: 1) they serve as the keystone for contemporary international norms relating to the use of biological agents as weapons; 2) they dramatically strengthen the disincentives and impediments state-sponsors of terrorism have for providing terrorists with biological weapons; and 3) they help minimize – or at least draw attention to – the availability

[18] Michael Barletta, Amy Sands and Jonathan B. Tucker, "Keeping Track of Anthrax: The Case for a Biosecurity Convention," *Bulletin of the Atomic Scientists*, May/June 2002, (www.thebulletin.org/issues/2002/mj02/mj02barletta.html) (Viewed on October 4, 2001)

[19] The 1925 Geneva Protocol and the Australia Group also seek to limit the spread of chemical weapons.

of certain dual use items that might be exploited by terrorists seeking a biological weapons capability. Successfully strengthening existing multilateral efforts (such as finding an internationally acceptable approach to compliance enforcement in the BWC); fostering emerging multilateral nonproliferation efforts (such enlarging participation in the recently launched Proliferation Security Initiative); and exploring new cooperative nonproliferation options (such as expanding the UN secretary general's authority investigate allegations of biological weapons development, production or possession), offer important opportunities to address the spread of biological weapons capabilities to both state and non-state actors. One must bear in mind, however, that nonproliferation initiatives can at most present a partial and secondary approach to the problem, one that must be supplemented with a variety of other preventative measures (such as intelligence and law enforcement) at both the national and international levels.

5. **Improve relationships between science and law enforcement communities.** Conventional terrorism is largely addressed by national law enforcement, intelligence and military agencies. The threats posed by bioterrorism, however, involve a host of technical issues – relating to public health, the environment, and agriculture, for example – that fall outside the traditional jurisdictions and core competencies of such organizations. Today, few if any of these government functions possess the epidemiological expertise and scientific capabilities necessary to adequately address bioterrorism. National and international organizations responsible for dealing with terrorism-related matters should be encouraged to develop strong working relationships with public health and biological sciences communities as quickly as possible. Such relationships will improve existing capabilities to identify and address biothreats *before* incidents occur. At the same time they will strengthen the ability of particular organizations and broader communities to respond to bioterrorism if and when incidents do occur. Perhaps most important, enhancing relations between science and enforcement communities will help foster a new epistemic community capable of keeping pace with the rapid changes that can be expected in the quickly evolving worlds of both biotechnology and genetics, and politics and terrorism.

6. **Enhance global preparedness and response capabilities.** Adequate preparedness and response capabilities may not prevent bioterrorism, but they are essential for minimizing the casualties, economic damage, contamination, strategic function interruptions and fear that might result from successful bio-attacks. Robust disease surveillance and identification systems are particularly important tools for mitigating the impact of bioterrorism. They both facilitate the early detection of and rapid response to outbreaks, as well as strengthen a community's overall public health capabilities. If effective, such systems can greatly reduce a number of the strategic incentives terrorists have for using biological weapons (mainly by reducing the "reliability" of certain desired outcomes). While many preparedness and response issues are best considered at the local and national levels, several particular matters should be raised at the international level:

    - Identify public health as a key component of international security. According to the World Health Organization, at the end of the past century a quarter of all the world's deaths – and half of all deaths in developing countries – were caused by infectious disease. In many poorer countries, natural disease already overburdens public health services, exacerbates poverty, hinders development, and destabilizes communities. The additional burdens caused by the deliberate use of biological weapons – against human or agriculture targets – could significantly undermine the broader security situations of some regions. Recognizing that many states will be unable to address the emerging challenges of bioterrorism alone, and that diseases – especially those caused by infectious agents –can spread rapidly across borders, the international community should identify public health as a common security concern and promote cooperative strategies for improving preparedness and response capabilities (such as the WHO's Global Outbreak Alert and Response Network).

    - Encourage realistic, "dual-use" national bioterrorism response strategies. Early identification of bioterrorism vulnerabilities and regular, well-coordinated contingency planning are two of the most effective ways in which states can prepare against

bioterrorism. Systematic threat assessments can help states identify the relative risks presented by bioterrorism and aid them in efforts to correctly focus policies and prioritize the use of limited resources. When possible states should be encouraged to take advantage of "dual-use" opportunities that allow them to develop their public health and safety, food and water, and additional pertinent infrastructures in ways that mitigate the threat of bioterrorism and address other public priorities. When possible such efforts should also leverage public-private partnerships, especially in sectors such as agribusiness, pharmaceuticals and biotechnology.

- Emphasize the importance of crisis communication. For a variety of psychosocial reasons, attacks involving biological agents evoke particularly strong public emotions. An essential – but often forgotten – element of any local, national or international bioterrorism contingency plan is a *predetermined* media plan that can be immediately deployed. Providing early, accurate and regular information is essential for: 1) calming public fears; 2) minimizing rumors; 3) establishing trust and authority, which may be necessary for directing later public response activities; and 4) preventing other "competing" information sources – such as media experts or terrorists – from accidentally or intentionally misinforming the public. Given the possible regional or global ramifications of some bioterrorism incidents, communication plans should involve strategies designed for multiple audiences and identify mechanisms that facilitate communication coordination between authorities in multiple locations.

- Promote cooperative biopreparedness research and disseminate lessons learned. Given that bioterrorism is largely a new and uncommon phenomenon, many of the best tools and approaches for addressing its challenges are accessible only through resource intensive research and practical experience (including that provided by training and simulations). Few nations have the independent financial and logistical capabilities necessary to engage in such efforts entirely on their own. The international community should promote collaborative efforts to improve the exchange of biopreparedness knowledge between governments and authorized responder communities. One possible way this might be accomplished is by establishing an international biopreparedness center that facilitates the systematic collection and dissemination of non-sensitive biopreparedness information.

List of published studies and papers
All papers and studies are available as pdf-files at the Commission's website: www.wmdcommission.org

No 1 "Review of Recent Literature on WMD Arms Control, Disarmament and Non-Proliferation" by Stockholm International Peace Research Institute May 2004

No 2 "Improvised Nuclear Devices and Nuclear Terrorism" by Charles D. Ferguson and William C. Potter June 2004

No 3 "The Nuclear Landscape in 2004: Past Present and Future" by John Simpson, June 2004

No 4 "Reviving the Non-Proliferation Regime" by Jonathan Dean, June 2004

No 5 "Article IV of the NPT: Background, Problems, Some Prospects" by Lawrence Scheinman, June 2004

No 6 "Nuclear-Weapon-Free Zones: Still a Useful Disarmament and Non-Proliferation Tool?" by Scott Parrish and Jean du Preez, June 2004

No 7 "Making the Non-Proliferation Regime Universal" by Sverre Lodgaard, June 2004

No 8 "Practical Measures to Reduce the Risks Presented By Non-Strategic Nuclear Weapons" by William C. Potter and Nikolai Sokov, June 2004

No 9 "The Future of a Treaty Banning Fissile Material for Weapons Purposes: Is It Still Relevant?" by Jean du Preez, June 2004

No 10 "A Global Assessment of Nuclear Proliferation Threats" by Joseph Cirincione, June 2004

No 11 "Assessing Proposals on the International Nuclear Fuel Cycle" by Jon B. Wolfsthal, June 2004

No 12 "The New Proliferation Game" by William C Potter, June 2004

No 13 "Needed: a Comprehensive Framework for Eliminating WMD" by Michael Krepon, September 2004

No 14 "Managing the Biological Weapons Problem: From the Individual to the International" by Jez Littlewood, August 2004

No 15 "Coping with the Possibility of Terrorist Use of WMD" by Jonathan Dean, June 2004

No 16 "Comparison of States vs. Non-State Actors in the Development of a BTW Capability" by Åke Sellström and Anders Norqvist, October 2004

No 17 "Deconflating 'WMD'" by George Perkovich, October 2004

No 18 "Global Governance of 'Contentious'" Science: The Case of the World Health Organization's Oversight of Small Pox Virus Research" by Jonathan B. Tucker and Stacy M. Okutani, October 2004

No 19 "WMD Verification and Compliance: The State of Play" submitted by Foreign Affairs Canada and prepared by Vertic, October 2004

No 20 "WMD Verification and Compliance: Challenges and Responses" submitted by Foreign Affairs Canada, October 2004

No 21 "Meeting Iran's Nuclear Challenge" by Gary Samore, October 2004

No 22 "Bioterrorism and Threat Assessment" by Gary A. Ackerman and Kevin S. Moran, November 2004

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