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The Bioterrorism Threat and Dual-use Biotechnological Research: An Israeli Perspective

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Abstract Israel has a long history of concern with chemical and biological threats, since several hostile states in the Middle East are likely to possess such weapons. The Twin-Tower terrorist attacks and Anthrax envelope scares of 2001 were a watershed for public perceptions of the threat of unconventional terror in general and of biological terror in particular. New advances in biotechnology will only increase the ability of terrorists to exploit the burgeoning availability of related information to develop ever-more destructive bioweapons. Many areas of modern biological research are unavoidably dual-use by nature. They thus have a great potential for both help and harm; and facilitating the former while preventing the

In November 2005, a special Steering Committee on Biotechnological Research in an Age of Terrorism (Prof. Alex Keynan, Chairman) was established jointly by the Israel Academy of Sciences and Humanities and the Israel National Security Council to address the problem of biosecurity and biological research. The committee's report "Biotechnological Research in an Age of Terrorism" is currently under internal and external review. This paper is based on that report and its recommendations. It is also based on a related paper presented at a conference on The Advancement of Science and the Dilemma of Dual Use, recently hosted by the Polish Academy of Sciences (Warsaw, Poland, 09–10 November 2007).

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latter remains a serious challenge to researchers and governments alike. This article addresses how Israel might best (1) prevent hostile elements from obtaining, from Israel's biological research system, materials, information and technologies that might facilitate their carrying out a biological attack, while (2) continuing to promote academic openness, excellence and other hallmarks of that system. This important and sensitive issue was assessed by a special national committee, and their recommendations are presented and discussed. One particularly innovative element is the restructuring and use of Israel's extensive biosafety system to also address biosecurity goals, with minimal disruption or delay.

Keywords Biosecurity · Bioterror · Dual-use · Biosafety · Academic freedom/responsibility · Recommendations

Introduction

Offensive biological weapons (bioweapons) are hardly new. In the fourteenth century, Crimean Tatars catapulted plague-infested corpses into an Italian trade-settlement and, in the beginning of the nineteenth century, blankets infected with smallpox were deliberately distributed among native Americans [1]. Both before and after the Second World War, the U.S. and the U.S.S.R. developed and acquired significant amounts of chemical weapons and bioweapons for use in bombs, artillery and warheads. These weapons supplemented the superpowers' deterrence strategy, which was based primarily on nuclear weapon capabilities. Other developed countries also acquired chemical and biological weapons capabilities; and, eventually, developing countries (for example, Syria, Egypt, Iraq, Iran) joined the race [2, 3]. The latter regarded bioweapons as more attainable substitutes for nuclear capability.

From a technological point of view, most of these bioweapons were based on native virulent biological agents—bacteria, viruses or toxins—cultured and then weaponized into bombs and missile warheads. In several cases advanced technology was used to prepare dry powders, which can be more effectively aerosolized. In the late 1990s the Soviets used genetic engineering methods to produce new virulent strains.

Global strategic and political changes have also influenced the nature of the biothreat. These include a 1968 U.S. moratorium on biological weapons, the dissolution of the Soviet Union and the first and second war in Iraq. These events and U.S.-led political activity to prevent the proliferation of weapons of mass destruction (WMD) have led to a decrease in the perceived strategic importance of biological weapons in most developed nation-states.

In contrast, bioweapon agents now offer terrorist groups new means for achieving their goals via an 'asymmetric' war, whose main objective is to cause massive casualties, panic, demoralization and economic disruption. The potential danger of such bioterrorism is great, and it depends mainly on (1) the nature of the agent and (2) the method of dissemination. Natural pathogenic bioagents might yield limited results (although some are quite virulent); but weaponized strains, such as the Anthrax used in the U.S. mailing scare, can be prepared if one has the technology, or they can be stolen or smuggled from state-owned stockpiles.

The most dangerous and potentially devastating threat lies in the use of advanced biotechnological methods to prepare new or modified microorganisms. Although new molecular biological technologies promise great benefits, they could also be used to create, for example, hypervirulent microorganisms resistant to existing antibiotics and vaccines. Such advanced technologies may initially be available only to a select few; but the rapid dissemination of information through modern communications could help hostile forces use such advances to develop sophisticated, dangerous biological weaponry that would be very difficult to counter. Recent reports and articles conclude that dramatic advances in the life sciences expected in the twenty-first century, and the accessibility and widespread dissemination of related technology and information, could enable terrorist organizations to develop or obtain biological weapons capable of causing enormous damage [4, 5].

We can therefore expect, during the next 10–20 years, a need to thwart actions taken by independent (or state-supported) terrorist groups using standard, weaponized or genetically engineered pathogenic agents. It will become increasingly imperative to prevent knowledge, organisms and materials relevant to the production of bioweapons from reaching hostile hands.

Since the Twin-Tower terror attacks and Anthrax envelopes scare of 2001, the U.S. government and public have begun to see nonconventional terror and biological terror (bioterror) as credible, dangerous new threats. Several recent U.S. reports and articles have documented and analyzed this threat and its future implications [6, 7]. In response, the U.S. has openly declared a 'war against terror' and has sought to prevent terror organizations from accessing material, facilities or information originating in U.S. research laboratories.

The U.S. response is built on four foundations: deterrence, prevention, defense and response, and it is investing considerable effort and resources simultaneously in all four areas. Existing laws have been reinforced and new legislation passed to facilitate these efforts. European countries have also joined this crusade, although, with the exception of the U.K., with less decisiveness and determination.

Biosafety, Biosecurity and Biodefense

The term *biosafety* has been familiar for many years and has no direct connection to biosecurity. It signifies the entire set of physical and administrative means that help prevent accidents and harm while using dangerous biological agents. In recent years, effective biosafety laws and regulations have been passed, their requirements have been successfully imposed, and effective inspection regimes have been established.

In contrast, *biosecurity* is a relatively new term, denoting the sum total of measures meant to prevent terrorists and other hostile powers from obtaining dangerous biological agents, technologies or information that would allow them to make biological weapons. Nonetheless, the requirements of biosafety and biosecurity (and the means used to achieve them) do overlap to a considerable extent.

Biosecurity measures can be divided into seven categories:

- Physical containment of dangerous organisms

- Preventing leakage of relevant information and materials
- Reporting and inspecting work with dangerous organisms
- Transport and transfer security
- Worker reliability
- Information security
- Integrated overview of scientific research programs

Biodefense and *consequence management* constitute measures taken to minimize or counteract the consequences of a biological attack after it has occurred. These are not the focus of the present article.

New Biological Technologies: A Double-edged Sword

Biotechnology, genetic engineering, molecular biology (e.g. the molecular basis of pathogenecity) and complementary fields, such as informatics and nanotechnology, began to develop at an unprecedented pace towards the end of the last century. Forecasts indicate that this pace will conintue to increase exponentially, even if its precise directions are unknown. Although this research and development seeks to benefit humanity, hostile forces could also take advantage of recent and future biotechnological advances to harm humans and other living organisms on a catastrophic scale. This is not to underrate the bioweapons potential inherent even in the technologies of classic biology, which include methods for producing massive quantities of pathogenic bacteria and viruses and sophisticated ways to store and disperse large quantities of such agents [8].

By the 1980s, researchers were already expressing concern that recombinant DNA technology might be put to unacceptable use. While most discussions concerned more basic ethical issues, the possibility of providing dangerous capabilities to terrorists was also explicitly considered. Today, astonishing as it may seem, that technology has been largely superseded! Subsequent advances in DNA synthesis and cloning will soon make it possible to produce any desired gene rapidly on an industrial scale at minimal cost. One needs only the necessary enzymes and a single copy of the gene to be reproduced. Soon even the original gene will not be required, since just its nucleotide sequence could suffice for chemical synthesis [9].

There are other important advances that go hand-in-hand with this gene production capability. The genomes (the entire genetic codes) of many organisms have already been mapped, and this number is growing at the rate of about 10 eukaryote and 100 prokaryote genomes a year. This huge amount of information is freely available, and the list of organisms whose genome has been sequenced is hardly selective in terms of biological risk. For example, the genome of the Spanish flu virus has been published, and so has an article that describes how to make a virus out of a genome map. Eventually, it will be possible to manufacture entire genomes of a pathogenic virus, for example, at low cost and with huge speed. For example, by 2010, a single laboratory technician should be able to produce or transcribe a DNA chain of 10^{10} base pairs (the individual components of DNA) in a single day. This is three times the length of the entire human genome! The same technician

would be able to produce both genes to be used in genetic medicine and genes that encode pathogens or resistance to antibiotics. Even virulent and dangerous proteins might have bioweapons potential [10].

Other advances that are potentially exploitable by hostile forces include research on transgenic organisms, on weak links in the immune system (see next section), and impressive developments in producing drug targeting and delivery mechanisms. In light of the almost unlimited technological possibilities, questions such as whether it is possible to engineer more dangerous pathogens now assume a meaning quite different than in the previous century [11].

Such biological developments often appear suddenly, unexpectedly and by chance. For example, small interfering RNAs (RNAi), the topic of a 2006 Nobel Prize (A. Fire, C. Mello), was first discovered by chance during research on producing multicolored petunias [12]! Specific predictions regarding future biological discoveries are thus difficult to make; and biosecurity policymakers must stay up-to-date if they are to be effective.

The "Dual-use" Dilemma

The term 'dual-use' originally denoted technologies that could be used for both civilian and military purposes. It was broadened to include terrorist purposes, when that became relevant. The fear of the hostile use of dual-use biological and biotechnological research exists on several levels, beginning with ostensibly civilian enterprises that secretly pursue exceptional applications. These can range from the conversion and exploitation of dual-use equipment or agents for terrorist purposes, to the use of biological information for bioweapons development.

Isn't all scientific research ultimately dual-use? Past proposals to completely block dual-use scientific research would have dealt a serious blow to the biological sciences. Some argue that, instead, biological research programs should be evaluated in terms of their benefits (e.g., potential to cure illness) and risks (e.g., potential for catastrophic adverse use). The problem with this approach is the difference between how we perceive benefits and costs. While every rational person understands the implications of a deadly terror attack, only a select few can foresee the results of a revolutionary scientific discovery. Usually, in fact, it is impossible to know whether (or how) any given research project will produce findings of practical value. Therefore, attempts to prevent future biological research might be influenced more by populist considerations than by professional, scientific ones.

Despite these caveats, one cannot ignore the risk of dual-use research, nor forget that some researchers might deliberately pursue harmful applications for ideological, practical or financial reasons. There are surely financial backers and states that might support such research.

To address the issue intelligently, dual-use research must be categorized. The first category includes research deliberately aimed at producing bioweaponry, even if it also produces useful civilian applications as a side benefit. This is of obvious concern. The second category comprises civilian research projects whose dual-use potential is known in advance. The third category encompasses research projects

that are thought to have dual-use potential, although such potential can be evaluated only once the research is completed. The fourth category includes research projects that were initially considered to be free of dual-use potential, but which unexpectedly produced findings with a potential for hostile use.

The latter is far from unlikely. For example, scientists in Australia sought to control the mouse population by developing a rodent contraceptive vaccine. They first created an attenuated, non-infective mousepox virus and then inserted into it the gene that codes for interleukin-4 (IL-4), expecting that it would boost antibody production in the vaccinated mice. When the engineered virus was injected into mice, it unexpectedly turned off their entire immune systems, killing them all [13]. This experiment demonstrated how easily a harmless virus could be converted into a lethal one. Mousepox, by the way, is very similar to the human smallpox virus, so terrorists could theoretically produce, in a similar fashion, a lethal smallpox virus from vaccinia (the cowpox virus), which is routinely used for vaccination against smallpox.

It can even be difficult to control research-based information whose dual-use potential was evident from the start. For example, in 2005, an American team—after consulting appropriate authorities at the U.S. Center for Disease Control (CDC), National Institutes of Health (NIH/NIAID) and the National Science Advisory Board for Biosecurity (NSABB)—published the complete genomic sequence of the Spanish flu virus, the cause of the flu pandemic that killed millions of people in 1918–1919 [14]. In a subsequent project, researchers synthesized an entire (different) virus in the laboratory and showed, by injecting it into mice, that their artificial virus was highly virulent and lethal [15].

Both studies were publicly published in full and their details are available to anyone interested in them for any purpose, although they could potentially aid the development of one of the most deadly bioweapons ever known. In fact, the Spanish flu virus research was performed and published despite the considerable public criticism that had been leveled at a previous project that described the chemical synthesis of a complete polio virus [16]. Similar concerns arise from work on antibiotic-resistant Anthrax strains [17].

Combating The Bioterror "Dual-use" Threat

Since the nature of the bioterror threat is so complex, and the number of unknowns is so large, a multisystem strategy is essential. Such a comprehensive plan must address prevention, defense and consequence-management. The objective of *prevention* is to prevent (or limit) hostile forces from obtaining, developing, producing or using biological weapons. To prevent states with developed scientific and technological infrastructures from obtaining and producing bioweapons is almost impossible, although sometimes they can be deterred from using them. On the other hand, it should be possible, if difficult, to prevent terrorist organizations from obtaining bioweapons, especially the more sophisticated, advanced and dangerous ones. However, this would require global cooperation, something not forthcoming when the terrorist organization has a national sponsor or purveyor.

Traditionally, the majority of resources have been invested in *defense*, a strategy composed of protection, detection and early warning. When the main threats were from states, this was justified. In order to design, develop and acquire an effective defense system, it was necessary to have accurate intelligence data concerning the enemy's plans. This was possible, albeit difficult, when dealing with a hostile state. In contrast, it is almost impossible to predict the exact scenario of a bioterror attack. Therefore, defense systems may not give an optimal response when the attack occurs.

The goal of *consequence management* is to treat and save the lives of mass casualties resulting from the attack. The basic building blocks of this layer are mainly medical measures, decontamination procedures, quarantine and evacuation. The source of the attack (terrorists or states) is irrelevant. The only parameters which count are the number of casualties and the nature of the disease. Therefore, a country that is well-prepared for a state-based biological threat, will be also prepared for a bioterror attack. Moreover, since there is a great similarity between a bioattack and a natural epidemic, the most cost-effective approach is a "dual-use" medical system, in which the national medical system is prepared for both cases.

The View from Israel

Unfortunately, Israel has had fifty years of experience in fighting conventional terrorism of various kinds. It also has been living, for most of the time, under the shadow of a concrete chemical and biothreat from most of its neighbors (Egypt, Syria, Iraq and Iran). Over the years, Israel—in terms of the above 4-layer system—has developed very good defense and public health (*consequence management*) systems. It should be emphasized that the chemical and bioweapon threats are not only a military one; they are also a concrete threat to our civilian population.

When the biothreat first emerged, at the end of the 1990s, Israel recruited all its know-how and resources to modify its existing *defense* systems to include the new scenario. More recently, Israel has also begun to increase its emphasis on and activity in *prevention*. Israel fully cooperates with all the main international non-proliferation initiatives, including legislation, export control regimes, and so on. Biosecurity (*deterrence*) measures, the subject of this article, are now the next area for upgrading (see below).

Regulation of life science research in Israel is largely limited to biosafety concerns and takes into account the unique structure and emphases of Israel's scientific research system. The lion's share of Israel's life sciences and medical research and development is conducted at Israel's seven major research universities and academic research institutions.[1]

These universities are public and most of their financial support comes from the Planning and Budgeting Committee of Israel's autonomous Council for Higher Education, which allocates the government's budget for higher education. All Israeli

[1] The Hebrew University, Tel Aviv University, Ben-Gurion University, Bar-Ilan University, the University of Haifa, the Technion-Israel Institute of Technology and the Weizmann Institute of Science.

institutions of higher education share a similar organizational structure, headed by a president, who usually appoints a vice-president for research and development. University life scientists enjoy exceptional academic freedom, although their work is supervised administratively and ethically by institutional safety, biosafety, animal experimentation, and bioethics committees. A national council also reviews compliance with an Animal Experimentation Law that establishes standards for the use of research animals. Research performed in university hospitals on human subjects has to comply with national regulations for human experimentation. Work with biohazard agents and poisons are regulated under Israel's extensive biosafety legal infrastructure; there is no equivalent biosecurity infrastructure.

All Israeli academic institutions also have appropriate procedures and organizational infrastructure to ensure compliance. Since these are already in place, familiar and widely accepted—with minimal friction—by academia, they might also be modified to provide an effective oversight mechanism for introducing and enforcing subsequent biosecurity regulations (see next section). In fact, Israel's *national* academic biosafety procedures are continuously improving, since *international* research funding agencies are increasingly demanding effective biosafety supervision in the foreign laboratories they support, and since Israeli researchers are highly motivated to remain internationally competitive. These international concerns might well include biosecurity in the near future.

All Israeli academic research institutions have safety units, a full-time safety director, and safety committees. Each safety system complies with the relevant laws and the directives of the Ministry of Industry, Trade and Labor (MITL) Workplace Inspection Division. Relevant laws include the Workplace Safety Order (1970), the Workplace Inspection Organization Law (1945), and the Safety Oversight Order for Medical, Biological and Chemical Laboratories (2001). Institutional safety officers oversee work with human blood and tissue samples, DNA manipulation, toxic materials and pathogenic organisms. Workplace regulations and guidelines are constantly updated, and laboratories are inspected regularly to ensure compliance. Record-keeping and periodic reporting regarding high-risk materials are required, and automated systems are being created to track the purchase of dangerous strains and special biological materials. Safety authorities also conduct instructional workshops for scientists, laboratory workers and students in safety procedures. So Israeli researchers are no stranger to (and have learned to live successfully with) a certain amount of well-justified regulation.

Biosafety oversight in academia takes place at two main focal points: first, when research proposals are submitted for funding agency review and, second, when the research is performed. In some institutions, when a research project requires a safety certification, the safety division first has to confirm that the laboratory's work conditions meet all legal requirements.

Local funding agencies also play their part. For example, the Israel Science Foundation (ISF), Israel's largest and most important source of biomedical research funding, requires that grant applications be endorsed by the recipient institution and by its Helsinki Committee (for experiments involving human subjects) or by its Institutional Committee for Animal Experimentation (for animal experiments) or other relevant bodies. For example, work with genetically engineered plants must be

approved by the National Committee for Transgenic Plants (NCTP). At present, the ISF itself does not require institutional certification of either biosafety or biosecurity.

The COBRAT Report and its Recommendations

The big challenge now is to incorporate biosecurity concerns into this system, in particular, to upgrade measures to prevent the leakage of dangerous organisms, information and technologies to terror organizations. To this end the Israel National Security Council (INSC) and the Israel Academy of Sciences and Humanities (IASH) initiated a national project, Biotechnology in an Age of Terrorism, and formed a special Steering Committee on Biotechnology Research in an Age of Terrorism (COBRAT) to analyze and report on the current situation and to recommend future action. The committee was composed of well-known scientists and biologists from Israeli academia and industry and experts in regulatory and legislative law.[2]

COBRAT took the above situation as its starting point in seeking more effective and systematic ways to meet biosecurity concerns without compromising academic freedom and creativity. In its final report the Committee formulated specific recommendations to address:

- Changes required in Israel's existing legislative infrastructure,
- Compilation of an updatable list of biological agents and research topics requiring inspection and supervision,
- Establishment of a regime for tracking, supervising and enforcing all areas of biosecurity,
- The need for a national interministerial body or professional committee to guide, monitor and maintain biosecurity.

In pursuing these goals, COBRAT was confronted by several daunting but not atypical facts: (1) no biosecurity legislation exists in Israel, (2) the legislative process, as practiced by the Israeli parliament (Knesset), is long, complicated and uncertain, (3) a response to the bioterror threat cannot wait for long-term solutions. COBRAT's innovative yet practical interim solution to this particular problem (Recommendation 3) may also serve as a useful model for others. As mentioned above, Israel does have a well-developed legal regime that defines biosafety regulations and responsibilities in Israeli governmental, academic and private laboratories. COBRAT, therefore, recommended modifying Israel's biosafety committees and empowering them, by executive order, to undertake responsibility for biosecurity concerns as well. In addition to reducing duplication, disruption and delay, this scheme avoids many of the sensitivities, suspicions and conflicts inherent in the regulation of dual-use research. The existing biosafety committees are of long

[2] Members: A. Keynan (chairman), D. Friedman (coordinator), Y. Aharonowitz, S. Berman (after 03/06), H. Bercovier, E. Bibi, M. Gabai (until 03/06), Y. Danon, M. Hertzberg, S. Michaeli, B. Rager, N. Sharon, A. Shapira.

standing, they are sensitive to scientific (and personal scientist) concerns, they are well-tolerated by the scientific and academic community, and they are unlikely to trigger the hostility and 'graft rejection' typical of introducing a 'foreign body' into academia. Trust and comfort are intangibles, but their effects are all too real.

With this introduction let us proceed to the committee's (edited) recommendations.

Recommendation 1—Awareness, Consciousness and Education

An ongoing effort should be initiated to raise awareness and understanding of the risks associated with the biological threat in general, and with dual-use biological research in particular, within the Israel's life and medical research and development community.

Recommendation 2—Existing and New Legislation

Legislative solutions must be addressed on two levels:

- Since the creation of totally new legislation, under Israeli conditions, can be a long, slow and uncertain process, the Committee recommends that existing Israeli secondary legislation on biosafety should immediately be used as a model for ministerial executive orders and institutional (e.g., university) procedures designed to prevent the potential seepage of organisms, materials and information to hostile elements.
- In parallel, specific longer-term legislation should be formulated. This legislation must be comprehensive and cover all aspects of biosecurity.

Recommendation 3—Oversight and Supervision Mechanisms

The fastest, most efficient and least disruptive way to enforce a regime ensuring biosecurity is to upgrade and adapt existing institutional biosafety oversight procedures to also assure biosecurity. Local responsibility for the enforcement should be delegated to existing institutional biosafety committees—renamed renamed "institutional biosafety and biosecurity committees" (IBBC)—for the academic sector and special Central Biosafety and Biosecurity Committees for biomedical laboratories affiliated with government ministries. National biosecurity policy, procedures and enforcement should be overseen by a National Biosecurity Council (NBC) to be appointed by the Ministry of Health (MOH). The NBC should also be responsible for the initiation of a training regime for all the local biosecurity and biosafety committees in all matters related to their additional tasks.

Recommendation 4—List of Dangerous Agents

There should be an itemized core list of dangerous agents. Not all biological agents should be placed in this category. The list of agents issued by the U.S. Department of Health and Human Services was adopted as the initial core-list. The list should be

reviewed and updated annually, as required, by the NBC. The Committee emphasizes, however, that sensitive dual-use data and information are not limited to research connected with these agents, but also can stem from work with other, in themselves harmless, strains.

Recommendation 5—Oversight and Approval of the Publication of Information Generated by Dual-use Research

This sensitive subject must be an essential part of Israel's biosecurity policy. Given the risks involved, it is recommended to establish a system to oversee and approve the publication of the results of dual-use research projects. This should be undertaken by an internal mechanism based on the judgment of the academic community itself. Professionalism, balance and lack of undue delay will be essential to ensuring acceptance.

In its comments regarding implementation, the Committee noted that it is best to address this problem before, not after, the research is conducted. That is, "potential for bioterror risk" should be noted in proposals sent to the institution's grant-submitting body (e.g. Research and Development Authority). Arguments for pursuing research despite such risk would be vetted by the IBBC (and if necessary NBC). Hopefully, this would suffice for subsequent control to be responsibly exercised by the informed and sensitized scientists themselves, which would be far preferable to external control.

Recommendation 6—Consideration of Biosecurity Issues by Funding Agencies

It is recommended that the Israel Science Foundation (ISF) and government research foundations require, as part of their approval process, biosecurity approval from the applicant's institution. This would ensure that these issues are considered by applicant institutions and that proper safety and security measures are enforced. In the case of non-academic laboratory research, similar certification should come from the chairman of the Central Safety and Security Committee in the relevant ministry.

Recommendation 7—Oversight of Importation and Sale of Dual-use Biological Equipment and Agents

In addition to existing export regulations, the Committee believes that it is necessary to establish a system to oversee the Israeli import of dual-use biological laboratory equipment and biological agents, as defined by the (export) risk list maintained by the MITL Export Authority, as well as the sale of these items in the local market (in particular, the sale of used equipment). This list is based on the Australian Group list of dual-use biological equipment.

Recommendation 8—National Responsibility for Biosecurity

The establishment of a biosecurity regime and its enforcement should be assigned to the Ministry of Health (MOH), which has both primary responsibility for public health and the requisite scientific knowledge and professional experience. MOH

should establish a National Biosecurity Council (NBC). The Chairman and members of the Council should be appointed by the Minister of Health in consultation with the head of the National Security Council and the president of the Israel Academy of Sciences and Humanities.

The COBRAT report and its recommendations are now undergoing internal and external review. Once approved by the INSC and IASH, they will be forwarded to Israel's Interministerial Committee on Science and Technology (ICST). The COBRAT report and its recommendations are now undergoing internal and external review, before final approval.

Conclusions

September 11 and the Anthrax scare have increased public awareness of the potential magnitude of the terrorist threat and the possibility of bioterror. Rapid advances in life sciences and anticipated developments in biotechnology, genetic engineering and other advanced technologies can be used to produce new treatments for serious diseases, but they also could be used by terror organizations to cause epidemics and other biologically related damage. The threat of non-conventional terror requires simultaneous action on several levels: deterrence, defense (which is of questionable effectiveness against terror), prevention, and preparations for responding to a potential attack.

The U.S. and other advanced countries have adopted laws, regimes and initiatives designed to prevent the spread of hazardous materials and information to hostile elements. Although it is still too early for a full assessment, initial indications suggest that these actions may be effective in reducing the trade and transfer of nonconventional weapons, components and technologies to terrorist elements. (However, the current lull in large-scale nonconventional terror attacks could have alternative explanations.)

Israel shares a common interest with other countries combating the bioterror threat via proliferation prevention, the use of legislation and regulation, and the imposition of supplier and export control regimes. It must continue its coordination with international policy in this area, and promote the adoption and enforcement of relevant initiatives. It must increase awareness among its pharmaceutical and biotechnological industries and its academic community regarding the security risks posed by some life science research and development and set up mechanisms for coordination and cooperation between these bodies and appropriate government ministries.

The recommendations of Israel's COBRAT committee, and the findings and principles on which they are based, form a useful starting point for this effort. One particularly innovative element is the restructuring and use of Israel's extensive biosafety system to also address biosecurity goals, with minimal disruption or delay.

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