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Meeting Report

Prevention of Biothreats: A Look Ahead

Gigi Kwik Gronvall, Nidhi Bouri, Kunal J. Rambhia, Crystal Franco, and Matthew Watson

On October 6, 2009, the Center for Biosecurity of UPMC organized a 1-day conference, "Prevention of Biothreats: A Look Ahead," in Washington, DC. The conference was hosted in collaboration with the Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism, and it was funded by the Alfred P. Sloan Foundation. The meeting was attended by more than 150 administration officials, policy analysts, scientists, health leaders, congressional staff members, and members of the media to discuss strategies for countering biological weapons threats.

During the conference, participants discussed a wide range of U.S. government programs, international approaches, and nongovernment efforts aimed at preventing the development and use of biological weapons, including arms control and multilateral agreements; efforts to prevent the unlawful acquisition of materials, equipment, and information; deterrence, intelligence, and surveillance; and improving resilience to biological attacks as a means of dissuasion and prevention.

Given the wide range of activities and professional groups engaged in biothreat prevention efforts, it is rare for the entire community to convene as a single group. This meeting accomplished that—the first step toward generating promising new ideas and directions for biothreat prevention and promoting greater coherence in the biopreparation community.

This summary report was prepared by the staff of the Center for Biosecurity of UPMC to provide a brief synopsis of each day's panel discussions and individual presentations. Videos of the day's discussions, the conference agenda, speaker biographies, and background readings are available on the conference website: www.upmc-biosecurity.org/preventionconf.

Introductory Remarks

In his opening remarks, Dr. Thomas Inglesby, Director of the Center for Biosecurity of UPMC, said that the purpose of the conference was to "have a serious discussion about biothreat prevention issues across a community of people who work on distinct elements of biological threat prevention and response." He asked the audience to consider 4 propositions to help guide the day's discussion.

1. Biological threats are an increasingly serious and complex threat to national security. The most recent National Intelligence Estimate identified the threat of bioterrorism as the intelligence community's most significant WMD-related concern. This is because the knowledge, equipment, and pathogens required to construct a biological weapon are now globally dispersed, and there is no single technological methodology chokepoint or process that can be regulated to prevent the development of biological weapons.

Historical evidence confirms the effectiveness of biological weapons, on both a small scale such as the 2001 anthrax attacks, and on a large scale, such as the trials and demonstrations undertaken during programs for the development of offensive biological weapons in the U.S., UK, and former Soviet Union. Multiple assessments and reports from the U.S. government, the World Health Organization (WHO), and others have concluded that, absent a rapid and robust response, a biological weapons attack could results in thousands of casualties.

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Equally concerning is the extant intention to use biological weapons against the U.S. and other countries, as recently voiced by Al Qaeda (corroborated by discovery of evidence of biological weapons development following the U.S. invasion of Afghanistan in 2001) and radical environmentalist organizations. Barriers to the development have fallen quickly as necessary technologies advance and grow more accessible. It is now plausible for a terrorist organization, a small group, or even an individual to develop biological weapons.

2. The nuclear nonproliferation and prevention model does not apply to biological weapons; biological weapons require their own framework. As a point of reference, Dr. Inglesby briefly outlined the primary goals of nuclear nonproliferation and prevention efforts:

- Secure fissile material around the world.
- Secure highly technical information about nuclear weapons development.
- Prevent the emergence of new nuclear states and nuclear testing through inspections, aerial reconnaissance, and sophisticated seismic, hydroacoustic, radionuclide, and other forms of monitoring.
- Prevent the divergence of nuclear fuel into the weapons cycle.
- Maintain current and seek new treaty arrangements (NPT, Fissile Material Cut-off Treaty, CTBT) in pursuit of these policy goals.
- Maintain deterrence through nuclear forensics, attribution, and the promise of retribution.

Prevention of biological weapons requires a different model because biological material (pathogens) cannot be accounted for or regulated in the same way as fissile material. Unlike the relatively scarce supply of weapons grade uranium and plutonium in the world, biological materials are widely available in labs and in nature. It will be increasingly possible to synthesize organisms de novo. Additionally, nuclear weapons and technologies are almost universally controlled by countries, whereas biotechnologies and materials are widely dispersed and are not generally controlled by governments.

Detection and identification of biological weapons development is considerably more difficult than detection of nuclear weapons. Nuclear facilities have specific infrastructure requirements and signatures, and they are discoverable through a variety of techniques. In contrast, biological science facilities are small, heterogeneous, and widely dispersed, and almost all are dedicated to benevolent science aimed at improving health and economic well being. It will, therefore, remain exceptionally difficult to detect a biological weapons development facility.

Nuclear forensics is a well-established field, and the U.S. government is confident in its ability to attribute a nuclear attack to a foreign power. However, as evidenced by the tremendous effort required to attribute the Amerithrax attack, biological weapons forensics is far more complicated and challenging.

3. The goals of the bioprevention framework should be feasible. Dr. Inglesby observed that the day's discussion would be most valuable if it focused on *feasible goals* of bioprevention first, followed by evaluation of the merit of those goals—that is, will a particular policy or program bring us closer to achieving these goals? He offered the following questions for consideration:

- Can we control biological materials or information in ways that slow biological weapons development or use?
- Can we improve transparency among countries on biological weapons issues?
- Can we strengthen moral and behavioral norms against biological weapons?
- Can we improve intelligence and interdiction?
- Can we improve surveillance and international collaboration on infectious disease monitoring and response?
- Can we improve forensics, attribution, or deterrence?
- Can we strengthen biodefense as a means of dissuasion?

For each, Dr. Inglesby stressed the need to evaluate the feasibility, potential benefits, and potential adverse consequences.

4. Success is not guaranteed. Finally, Dr. Inglesby noted that, regardless of the prevention strategy pursued by the U.S., effectiveness cannot be assumed. Therefore, it is fundamentally important to national security that the U.S. bolster its capacity to respond rapidly and effectively to a bioweapons attack.

Approaches to Controlling Materials and Information

What role does strict control play in lowering the risk that biological weapons will be developed and used?

Moderator: Gigi Kwik Gronvall, Senior Associate, Center for Biosecurity of UPMC

Panel Participants:

- Carol Linden, Principal Deputy Director, Biomedical Advanced Research and Development Authority (BARDA), Office of the Assistant Secretary for Preparedness and Response, Department of Health and Human Services
- Gerald Epstein, Director, Center for Science, Technology, and Security Policy, American Association for the Advancement of Science (AAAS)
- Michael Gelles, Senior Manager, Deloitte Consulting LLP
- David Franz, Former Commander, USAMRIID; Member, National Science Advisory Board for Biosecurity
- Carrie Wolinetz, Director of Scientific Affairs and Public Relations, Federation of American Scientists for Experimental Biology (FASEB)

Overview and Background

This panel examined whether attempts to control biological materials and information play a role in reducing the risk that biological weapons will be developed and used. Such efforts are based on the premise that, without access to pathogens, relevant information, and/or laboratory equipment, potential U.S. adversaries will be unable to make biological weapons.

Current efforts to control materials and information include U.S. export controls and the U.S. Select Agent Program, as well as personnel reliability programs, enhanced physical lab security, and guidelines on the communication and development of dual-use information. The U.S. Select Agent Program registers and monitors laboratories and personnel that research and transport 82 human, animal, and plant pathogens. It is administered by the U.S. Centers for Disease Control and Prevention (CDC), the U.S. Department of Agriculture (USDA), and USDA's Animal and Plant Health Inspection Service (APHIS).

Personnel reliability programs are based on the model of the nuclear weapons complex and seek to ensure that those who work with biological agents of concern are trustworthy. Such programs may entail rigorous background checks and psychological tests prior to granting an individual clearance to work in a laboratory that handles select agents. There are no national standards for personnel reliability at this time, but some have called for them to be established. Panelists discussed the efficacy of such controls and offered suggestions for improvement.

Greater Control of Science Is Not the Answer

Dr. Epstein emphasized the idea that, in contrast to nuclear technologies, it is no longer possible to limit the proliferation of expertise in the biological sciences or the materials, facilities, and infrastructure to support research, development, and invention in the field. The practice of life sciences is now ubiquitous in the world. Dr. Epstein asserted that this is fundamentally a positive development in science and that further progress in the biological sciences should be promoted for the potential to improve the quality of life globally. Because of that potential, restricting the use of biology is not only impossible but immoral. Rather than control, Dr. Epstein promoted the idea of monitoring and transparency, suggesting that security should be the product of international engagement, collaboration, and enhanced epidemiologic capabilities. Dr. Linden concurred, noting that, since the insider threat cannot be reduced to zero, efforts to enhance security should focus on creating an open and transparent global bioscience community.

Dangers of Overregulation of Science

Dr. Linden provided an overview and history of the personnel reliability and lab security efforts in the U.S. Select Agent Program. She noted that substantial strengthening of lab security has been made since the anthrax attacks of 2001. However, some of the regulations enacted to date have produced unanticipated and unfortunate consequences. Dr. Linden said that, without justification, the addition of more restrictions and security measures may be overzealous.

Dr. Franz noted that the U.S. should continue to lead in the field and to lead the way in achieving security without hindering scientific research. To that end, he encouraged the avoidance of approaches that constitute "fighting the last war" and that will lead to overregulation of science; he advocated for creation of international partnerships in life sciences and health as being ultimately better for U.S. security, as it will lead to greater transparency among nations and development of better, shared biodefenses.

Positive Workplace Culture: More Effective than Personnel Reliability Programs

Dr. Gelles described the challenges of combating the insider threat, focusing specifically on the problems that attend (often misguided) efforts to screen for reliability using psychological testing. He explained that because people and their circumstances are dynamic and screening methods are static, screening is not the most effective approach. The more likely scenario is one in which a personal crisis leads a previously "secure" or reliable employee to engage in a potentially dangerous behavior that screening will not catch. The approach advocated by Dr. Gelles is one of astute and attentive management and collegial work relationships that support recognition of significant changes in colleagues. A secure laboratory workforce is one in which crises that may lead to potentially dangerous changes in personnel are noticed and addressed. Dr. Franz also emphasized that a positive work culture in the life sciences will provide more security than additional regulations.

Sensible Approaches to Regulation of Life Sciences

Dr. Wolinetz said that the scientific community is already committed to the nation's security, is already subject to significant regulation and oversight, and is not, in principle, opposed to regulation. She urged, however, that regulations should directly support the goal of security. Dr. Wolinetz called for a review of current systems with an eye to identifying areas in need of improvement, and she discouraged a reactive approach that leads to implementation of hastily construed new regulations in response to crises.

Panel Conclusions

The panel concluded that nuclear laboratory security programs do not apply to the biological sciences and that

biodefense requires its own approach, emphasizing the need for expanded international partnerships and enhanced capabilities in surveillance, diagnostics, and the life sciences around the world. While the insider threat cannot be eliminated, the U.S. government should be wary of creating unnecessary regulations and overly aggressive personnel reliability programs. Instead, the focus should be on making adjustments to the current system and building a culture in the life sciences that supports community-wide commitment to security.

International Treaties and Agreements

What role do they play in increasing transparency and setting moral and behavioral norms among nations?

Moderator: Gigi Kwik Gronvall, Senior Associate, Center for Biosecurity of UPMC

Panel Participants:

- Jonathan B. Tucker, Senior Fellow, James Martin Center for Nonproliferation Studies, Monterey Institute of International Studies
- Julie E. Fischer, Senior Associate, Global Health Security Program, Henry L. Stimson Center
- Terence Taylor, Vice President for Global Health and Security, Nuclear Threat Initiative; President, International Council for Life Sciences
- Kenneth Luongo, President, Partnership for Global Security

Overview and Background

Panelists examined the role that international treaties and agreements may have in increasing transparency between nations and in setting moral and behavioral norms. The international treaties and agreements that address biological threats include the Biological Weapons and Toxins Convention (BWC), the International Health Regulations (IHR), and United Nations Security Council Resolution (UNSCR) 1540. As background, Dr. Gronvall outlined a brief history of these agreements and their purposes:

- The BWC [http://www.opbw.org/] is the first treaty to ban an entire class of weapons. While it upholds a strong moral norm, some nations have flagrantly disregarded it. This has led to an attempt to create a verification regime, which failed in 2001. Many experts believe that, unlike nuclear weapons, verification for biological weapons is not possible. Currently, states parties hold a series of annual expert reviews focusing on BWC implementation.
- The IHR [http://www.who.int/ihr/en/] was originally intended to minimize disruption of trade in times of disease emergencies. In 2005, the WHO revised the IHR, transforming the agreement to serve as a means of enhancing transparency about disease outbreaks among nations. Under the IHR, nations are required to report to the WHO an event constituting a "public health emergency of international concern."
- UNSCR 1540 [http://www.state.gov/t/isn/73519.htm] aims to ensure that no state or nonstate actor is a source or beneficiary of weapons of mass destruction (WMD) proliferation. Under full implementation, the actions of each state are intended to strengthen international standards relating to the export of sensitive materials and to ensure that nonstate actors do not gain access to nuclear, biological, or chemical weapons, their means of delivery, or related materials.

Strengthening the BWC

Dr. Tucker emphasized that the BWC embodies a norm against the hostile use of disease. While necessary, this norm is not sufficient to promote adherence to the treaty. The BWC lacks a secretariat and robust institutional mechanisms for support, limiting the ability of some countries to actively participate in the BWC process. Dr. Tucker encouraged policymakers to focus on practical ways of building capacity to address the full spectrum of disease threats within the BWC expert group meetings. He explained the need to expand the current process of data exchanges with decision-making capabilities so states can reach agreements on the understandings and interpretations of the treaty, respond to changes in technology, and establish a set of best practices for biosecurity rules and regulations.

Universality and the BWC

Dr. Tucker addressed the issue of universality, explaining that there are currently only 163 states that are parties to the BWC, whereas the Chemical Weapons Convention (CWC), which has been in force for only 12 years, has 188 states parties. He also explained that the 3-person Implementation Support Unit in Geneva is supposed to promote universality of the BWC but lacks the resources to do so effectively. Dr. Tucker also emphasized that once the majority of countries have signed and ratified the BWC, it may become part of customary international law, meaning it will bind all states whether or not they are actually member parties. It is difficult to assess which member states are actually in compliance with the BWC because of the lack of verification measures.

Challenges in Implementing the IHR

Dr. Fischer highlighted how awareness of failed reporting of disease during the SARS outbreak catalyzed the adoption of IHR 2005. She explained how the revised IHR requires its 194 member states to develop the capacity to detect, report, and respond effectively to a public health crisis in near

real-time (24-48 hours), and how the WHO now collects information from nongovernmental organizations (NGOs).

The current H1N1 outbreak illustrates ways in which the IHR has been successful, as nations did indeed report cases as they occurred and the WHO responded accordingly. While the outbreak revealed the new emerging norm to share information, many countries took "non–evidence-based actions," such as restricting trade and travel. This highlighted a challenge in the implementation of the IHR—namely, the economic ramifications for countries that do report cases.

The main challenge in implementing the IHR is a state's ability to develop the capacity to detect, report, and respond to public health crises; otherwise, the system is only as good as its weakest link.

Biological Weapons Nonproliferation Is Not Nuclear Nonproliferation

Mr. Luongo addressed transnational challenges and the differences inherent in nuclear and biological weapons nonproliferation. While nuclear nonproliferation efforts have been successful, prevention of biological warfare must be approached independently of the nuclear agenda. He stated that an arms control model would not work in biological nonproliferation, mainly because of the variety of stakeholders and the constant change in technology. Mr. Luongo identified a need to create partnerships within the private sector and particularly within the biotechnology industry. He also noted that a more appropriate goal for the BWC may be to develop more confidence-building measures, as opposed to seeking verification.

Mr. Luongo further suggested that, just as the United Nations Security Council has put forth resolution 1887 to focus on nuclear nonproliferation, a similar treaty should be developed to address the proliferation of biological weapons. He focused on the need to develop a framework for identifying existing biological threats but not mandating implementation of a treaty. Treaties should allow for flexible implementation among countries, leaving detailed implementation up to individual governments.

Networks Enhance Prevention

Mr. Taylor discussed examples of effective networks and explained how their success is attributable to stakeholders' ability to control and set priorities. To ensure their effectiveness, prevention strategies must be complemented by direct actions in the private sector and among nonstate actors. Networks involving a variety of stakeholders in addition to governments can increase information sharing. He advocated for government support of such networks. Mr. Taylor offered examples of disease surveillance networks now operating that cross national lines, such as those in the Mekong Delta and the Middle East.

Panel Conclusions

The panelists concluded that the U.S. government can act in a variety of ways to strengthen the BWC and clarify reasons for state membership. The international community should explore how to provide more incentives to countries to report emergencies without exposing themselves to economic damage. While governments must be engaged in dialogues, there is a role for nonstate actors and the private sector in setting moral and behavioral norms among nations. All agreed that nonproliferation of biological weapons requires a tailored approach rather than one based on nuclear nonproliferation efforts.

Intelligence Community Efforts at Detecting or Interrupting Biological Weapons Development or Use

Panel Participants:

- Lawrence Kerr, Senior Advisor for Biological Sciences, National Counterproliferation Center, Office of the Director of National Intelligence
- Col. Randall Larsen, USAF (Ret.), Executive Director, Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism
- Linda Millis, Director, Private Sector Partnerships, Office of the Director of National Intelligence

Overview and Background

This panel provided an overview of the progress and challenges faced by the intelligence community in preventing the development and use of biological weapons. Historically, the U.S. has both overestimated and underestimated other nations' biological weapons because of the difficulty in discerning the intent and motivation behind the purchase of dual-use equipment for a laboratory. Col. Larsen illustrated the nature of this uncertainty by providing a recent example: On October 6, South Korea reported that North Korea has the ability to produce biological weapons using 13 different agents, including smallpox. While gathering intelligence on nation-states is not easy, gathering intelligence on activities of nonstate actors in time to prevent or respond to an attack is even more difficult.

Current Efforts

The panelists provided an overview of the different types of intelligence and described how various disciplines are applied to the task of collecting information. They distinguished among several types of intelligence:

- HUMINT (human intelligence): information gathered by interpersonal contact

- SIGINT (signals intelligence): information acquired through radar, telemetry, and interception and analysis of communications, such as emails, phone calls, and text messages among and between persons of interest
- MASINT (signals and measurement): qualitative and quantitative analysis of specimens, such as DNA, metallurgy, and electromagnetic radiation
- GEOINT (geospatial): information gathered by use of imagery to confirm consistency between images and other intelligence information
- OSINT (open source): the majority of useful intelligence information actually exists in open source materials. This is particularly true for life sciences.

Intelligence Workforce

The panelists stressed that, to further enhance bio-intelligence capabilities, more life scientists are needed in the intelligence workforce; they noted that the approximately 150 members of the conference audience outnumbered those currently working on biological weapons intelligence. Dr. Kerr also noted that, although many young scientists enter the intelligence arena, once they do so, they find it difficult to maintain their laboratory skills and expertise, and many are drawn to more profitable private sector positions. One current retention effort is a sabbatical program that allows scientists to return to academia to refresh their skills and conduct laboratory research. Dr. Kerr also described a proposal to create a program similar to the military's ROTC; the proposal calls for creation of a reserve corps of life scientists who could maintain their security clearances and be called to work during a national crisis.

Private Sector Partnerships

The panelists acknowledged that it would be impossible to develop internal expertise in the life sciences equal to that available externally, and they emphasized that the intelligence community must focus on outreach to private sector partners who can enhance biological intelligence capabilities. Such a program currently exists, but it is limited to private sector experts with security clearances; Ms. Millis suggested that this type of outreach should be expanded and not necessarily limited by security clearance. The panel noted private sector willingness to partner with the federal government in national security initiatives.

Panel Conclusions

The discussion focused on the need to build and maintain a life sciences workforce within the intelligence community and to leverage the vast expertise of the private sector to bolster biological intelligence capabilities. However, while preventing development and use of biological weapons is a high priority for the intelligence community, personnel and funding are not adequate to the task. The panelists observed that U.S. scientists should be aware that they may be targets of foreign intelligence efforts, and they called for an emphasis on maintaining a culture of safety and security within the scientific community.

Presentation: Kenneth A. Myers III

The Defense Threat Reduction Agency (DTRA) is a Department of Defense (DoD) agency charged with safeguarding the U.S. and its allies from the threat posed by WMDs, including biological weapons. For the past 15 years, DTRA's Cooperative Threat Reduction (CTR) program has worked to identify and secure WMDs or their components in countries around the world, focusing primarily on nuclear weapons in the former Soviet Union.

Mr. Myers, Director of DTRA, described his firsthand knowledge of the biological weapons threat, which is based on his experience at the Hart Senate Office Building, where he was a congressional staff member during the anthrax attacks of October 2001. Mr. Myers said that DTRA's biological threat reduction strategy is largely predicated on overlaying the successful Nunn-Lugar CTR model onto the biological weapons threat. DTRA has constructed reference laboratories in partner nations such as Armenia, Azerbaijan, and Georgia to secure "dangerous pathogens." Mr. Myers said that such aid should be expanded to failing states in order to deny America's adversaries access to the materials necessary to construct a biological weapon.

Future Directions

A recent National Academy of Sciences report titled *Global Security Engagement: A New Model for Cooperative Threat Reduction* recommended expanding CTR programs to include additional geographic locations and threats.[1] Although the original CTR model was effective in Russia, Mr. Myers asserted that future programs must be sensitive to cultural differences as well as the practical needs of a partner nation in order to be effective. Next generation CTR programs will likely include an increased emphasis on global health security, with particular emphasis on assisting with the promotion and development of infectious disease surveillance systems. Mr. Myers noted that existing CTR programs do have a history of engaging with the Russian bioscience community, and he plans to maintain and expand those relationships. Finally, future DTRA initiatives will use a flexible framework of bilateral and multilateral partnerships in order to maximize America's investment.

Surveillance, Attribution, and Deterrence

What roles do early outbreak warning systems, forensics, and deterrence play in lowering the risks of biological weapons development and use?

Moderator: Jennifer Nuzzo, Associate, Center for Biosecurity of UPMC

Panel Participants:

- Anne Harrington, Executive Director, U.S. National Academies of Sciences' Committee on International Security and Arms Control
- Louise Gresham, Executive Director, Health Security and Epidemiology, NTI Global Health and Security Initiative
- Jenifer Smith, Former Section Chief, Federal Bureau of Investigation (FBI) WMD Directorate
- John Vitko, Former Director of Biological and Chemical Countermeasures, Science and Technology Directorate, U.S. Department of Homeland Security

This panel considered whether and how disease surveillance, microbial forensics, and methods of deterrence are useful in lowering the risks of a biological attack.

Disease Surveillance Systems: Potentially Useful if Well Designed

Ms. Harrington and Dr. Gresham argued that disease surveillance systems, which are designed to detect and monitor naturally occurring outbreaks, could also help countries to prevent biological weapons development. They observed that surveillance systems must be a collaborative effort among nations. Dr. Gresham commented that it is particularly important that the country providing disease outbreak information benefits from the surveillance system, because some countries fear that the information they collect will not benefit them directly.

It was noted that the influenza tracking system is currently the best available in disease surveillance—it is a global system and is used annually. Ms. Harrington suggested that the broader biosurveillance community build on the success of influenza surveillance and design a robust system capable of tracking many diseases.

Microbial Forensics: Necessary, but Not Sufficient for Attribution

Dr. Smith addressed the use of microbial forensics for attribution, which entails tracking microbes based on their genetic and other scientifically distinguishable characteristics. Because microbial forensics does not lead directly to the source of an intentional biological agent release, attribution is the joint responsibility of science, law enforcement, and intelligence communities. Dr. Smith emphasized that the field of microbial forensics is still new, and it requires continued development, research, and oversight. Currently, the White House Office of Science and Technology Policy (OSTP) is developing a strategy for research and development of microbial forensics.

Deterrence: Possible, but Challenging

While Dr. Vitko believes it may be possible to deter the use of biological weapons, it is critical to understand the inherent challenges. The first challenge is the difficulty and impracticality (indeed, impossibility) of limiting the illicit transfer of materials, technologies, and knowledge, given that the proliferation of dual-use biotechnologies is accelerating at a pace comparable to that of information technologies. While global advances in biotechnology promise myriad positive health and economic benefits, the task of trying to control these new technologies out of concern for their potential danger is daunting at best. Dr. Vitko suggested that it may be immoral to prevent dispersion of beneficial technologies, and he emphasized the need to strike a constant balance between advancing new technologies to derive great benefit and attempting to limit or control them out of concern for safety and security.

Dr. Vitko identified attribution as the second challenge to deterrence and dissuasion as the third. Dissuasion, though perhaps the most easily overcome, means convincing potential adversaries that they have more to lose than gain in attacking with biological weapons. Addressing this challenge requires making the necessary case to Congress and the American people that the biological threat requires investment in preparedness and response systems. When investments are made in these areas, it lets an adversary know that the success of an attack will be uncertain. To widen this uncertainty, we need to put policies in place that hold nation states responsible for harboring groups or individuals that commit bioterrorist attacks. Finally, we need to strengthen the social and cultural norms against bioterrorism.

Panel Conclusions

National efforts to respond to outbreaks depend on an accurate understanding of a disease and how it is spreading. Therefore, shared and transparent disease reporting systems are needed. The U.S. government should build on current disease surveillance efforts, such as the Cooperative Threat Reduction (CTR) program, but new approaches are needed as well. Microbial forensics can play an important role in identifying and attributing the source of a biological attack, but there are limits to the capabilities of forensic efforts. Attribution of a biological weapons attack requires input from several sources in addition to forensics—among them,

intelligence and law enforcement. Consequently, efforts to strengthen capabilities beyond forensics are important.

Presentation: Richard Danzig

Dr. Danzig, Chairman of the Board for the Center for New American Security, asked the audience to consider what the president or a policymaker would want to know immediately following an attack with a bioweapon: what type of system would give us more information about the attacker, how the attack was carried out, and how the next attack could be stopped? Dr. Danzig asserted that we have fundamental deficiencies in our detection systems that require dramatic changes and improvement. He outlined the deficiencies of the BioWatch program and recommended investing in several specific enhancements to spark the evolution of detection systems.

What's Wrong with BioWatch?

1. BioWatch does not support interdiction. Dr. Danzig explained that because BioWatch does not provide data in real time, and because the system relies on too few sensors that are spread too far apart, it cannot reliably detect an attack with a biological weapon. Consequently, BioWatch does not support interdiction, which is crucial. He emphasized that any multibillion dollar system that has been years in development but does not allow the U.S. to know who attacked, when, and with what, and then to stop the next attack, is not justifiable. An effective tool for informing decision making must provide real-time information about the nature, location, and perpetrator of an attack; without this capacity, Dr. Danzig emphasized, BioWatch is inadequate.

2. BioWatch cannot provide situational awareness. Situational awareness, which depends on real-time data, is imperative for informed and rapid decision making. Dr. Danzig highlighted that BioWatch acts only as an alarm, because it can provide an alert about the occurrence of an event but will not provide the types of information necessary to create situational awareness for decision makers. As a result, decision makers will not have the data they need to execute an effective response or to engage in effective consequence management.

3. BioWatch will not detect new and engineered pathogens. Dr. Danzig emphasized that the current system is vulnerable and will be increasingly inadequate to the task of detecting bioattacks in the coming decade and beyond. Rapid advancements in the biological sciences will lead to engineered pathogens that are currently not, and likely never will be, on standard threat lists. He urged the development of systems able to detect spectrums of pathogens.

Interdiction, situational awareness, and the ability to address the full spectrum of threats are fundamental to effective biodetection systems. While no system is perfect, efforts to improve systems are necessary to maximize the development of efficient and robust consequence management programs. Dr. Danzig explained that the most powerful form of deterrence is the ability to catch a perpetrator and prevent future attacks. A system that robustly addresses this concern warrants investment. Furthermore, Dr. Danzig outlined his recommendations for future investment to improve the BioWatch program.

What Technological Advancements Warrant Future Investment?

1. Greater specificity in smaller, less expensive technology. Dr. Danzig emphasized the need for building greater specificity into BioWatch to enhance pathogen detection and to enable location of an attack. He also called for smaller, automated sensors that can be produced at significantly lower cost. This would allow for deployment to a much greater number of sites in much greater concentration, which will significantly enhance real-time surveillance, detection, and location capabilities. Additionally, he suggested that smaller, less expensive BioWatch sensors could be embedded within existing systems and that new sensing technologies could be incorporated into HVAC systems in buildings in a more widely distributed way.

2. Lidar technology to improve detection. Dr. Danzig suggested that the BioWatch system integrate the use of lidar (short-range lasers that examine clouds as they form). This would provide the ability to see aerosol clouds as they rise in the atmosphere, which would provide more real-time data. However, this type of technology can generate too many false-positives because of other factors that create clouds, and it can only detect aerosol attacks, limiting its potential utility to outdoor attacks.[2]

3. Tracking exposure in human hosts. Finally, Dr. Danzig recommended evaluating human hosts to determine exposure to a pathogen. He suggested that baseline measures of populations, such as volunteers from the emergency management community, followed by regular testing of the same people, would allow for detection of exposure in those specific populations; results could be extrapolated to the larger population in a given area.

Dr. Danzig concluded his remarks by saying that biological threats will persist far beyond any of the specific groups currently posing a threat to national security. They will persist because of the growth and power of biotechnology and the life sciences.

Biodefense and Resilience

What role does resilience play in dissuading and deterring biological attacks?

Moderator: Thomas Inglesby, Director, Center for Biosecurity of UPMC

Panel Participants:

- Col. Randall J. Larsen, USAF (Ret.), Executive Director, Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism
- Robert Kadlec, Former Director for Biodefense, Homeland Security Council
- Daniel Hamilton, Director, Center for Transatlantic Relations, Paul H. Nitze School of Advanced International Studies (SAIS), Johns Hopkins University

This discussion focused on the role that resilience might play in deterring a bioterror attack. For the purposes of this discussion, resilience refers to the ability to rapidly recover from and diminish the consequences of an otherwise catastrophic event. In the context of biological weapons, it is worth considering both deterrence by dissuasion—convincing adversaries that they should not pursue biological weapons—as well as deterrence by denial—convincing adversaries that they are likely to fail at their objectives with biological weapons.

Dr. Inglesby noted that, throughout history, potential attackers have been deterred by denial, either through the introduction of a new technology that denied them a previously available means of attack, or through development of a much stronger defense that convinced an adversary that an attack would fail (eg, strengthened embassy protections). In this context, therefore, the ability to deter by dissuasion or denial suggests the importance of building a strong and resilient biodefense that will convince adversaries that they will not succeed in their objectives by using biological weapons.

Preparedness as a Deterrent

Col. Larsen noted that if a nation, organization, or individual mounted a successful biological weapons attack, it would inspire others to attempt to achieve the same effect, thus increasing the odds of more biological weapons attacks. Conversely, an adversary observing little or no effect might be more likely to change tactics, reducing the odds of a biological weapons attack.

Col. Larsen asserted that the U.S. should focus its efforts on improving response capability, especially the ability to rapidly produce and administer a range of medical countermeasures (ie, drugs, vaccines) to the population. If the U.S. were to become truly resilient to biological weapons, then these weapons could effectively be removed from the broader category of weapons of mass destruction. Limiting the consequences of a biological weapons attack by preventing the potential for a "bio-Katrina" is a primary focus of the Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism.

Goals of Deterrence

Dr. Kadlec views deterrence as a "mind game" with 2 goals: (1) make would-be bioterrorists believe that the effects of a biological weapons attack will be far less severe than intended because the U.S. is able to mount a coordinated, robust response; and (2) make it well-understood that use of WMD, including biological weapons, will unquestionably result in harsh consequences for those deemed responsible.

In the previous panel, Dr. Smith noted that, although our ability to attribute a biological weapons attack is limited, great progress has been made since the Amerithrax investigation. As attribution capability is developed, it will increase America's resilience and enhance deterrence. Dr. Kadlec noted that we need to "maximize our collective security" by increasing the resilience of our allies, as our security depends on their resilience.

Resilience Requires International Collaboration

Dr. Hamilton echoed Dr. Kadlec's last point by saying that it would be insufficient to focus U.S. efforts on building resilience solely in the American homeland because "our resilience will rely on that of others." In addition to protecting human health, a goal of ongoing U.S. biodefense efforts should be to defend and strengthen the networks that uphold free societies and prevent major social disruption. Toward that end, Dr. Hamilton proposed that a collaborative, multisectoral approach that engages the international community would be of great benefit. Finally, Dr. Hamilton advocated the support of moral and behavioral norms against the use of biological weapons as a means to "dishonor the act."

Panel Conclusions

The panelists concluded that a resilient nation may act as a deterrent to would-be bioterrorists and that the U.S. government should continue to implement measures that improve the nation's ability to substantially diminish the consequences of a biological weapons attack. The role of deterrence in the context of biological weapons is still evolving. Building resilience through partnerships with other countries (eg, international partnerships to create medicines and vaccines or to conduct disease surveillance) requires increased effort and attention.

Closing Remarks

Dr. Inglesby summarized the main points of the day's discussion:

- **International norms must be robust.** Moral and behavioral norms against development and use of biological weapons are essential, and the international community must strive to deepen and preserve norms such as those embodied in the BWC.

- **Changes to the U.S. lab security regime must be evaluated carefully.** Serious unintended consequences could result from efforts to control pathogens, materials, and information beyond those controls already in place. Dr. Inglesby encouraged policymakers to assess carefully the current approach to U.S. lab security and the potential consequences of any planned changes to the U.S. lab security regime before introducing new regulations.
- **Transparency is essential to national biodefense.** Efforts should continue to make U.S. national biodefense programs as fully transparent as possible. Dr. Inglesby noted that the U.S. program seems at least as transparent as other national biodefense programs in the world, and other countries should be encouraged to pursue transparency. Because physical inspection and verification of all bioscience laboratories in the world is impossible, calls for such measures are distractions from improving transparency.
- **Intelligence plays a strategic role, but it is not likely to provide the tactical warning necessary for prevention.** Intelligence will continue to be a key component of prevention, but intelligence in this arena is particularly challenging, and there is no guarantee of its reliability in preventing development or use of biological weapons or in providing tactical warning of an imminent attack.
- **International engagement has a role in prevention.** Cooperative Threat Reduction (CTR) programs and other surveillance efforts are key to international engagement and to improving international public health, and they warrant continued support. It is important to examine how such programs can contribute most effectively to the goals of preventing biothreats.
- **Microbial forensics is a critical aspect of prevention.** Microbial forensics is a young but advancing field that can be an important element of attribution. Policymakers should support the advancement of this field.
- **Biodefense and resilience are key for prevention.** Prevention efforts are a critical component of building dissuasion and deterrence to development and use of biological weapons. They have the additional benefit of building our capacity to respond to diseases outbreaks domestically and internationally. Because we cannot guarantee the success of the nation's collective prevention efforts, the U.S. must build both its resilience and a strong biodefense in order to diminish the consequences of potential biological threats.

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