The Problem of Biological Weapons: Next Steps for the Nation

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In this presentation I discuss proposals regarding where the nation needs to go and list the top actions that I believe are necessary in the next two years to deal with the problems of bioweapons and bioterrorism. First, however, I will consider the larger context of the bioweapons problem.

Where do we stand at this point, at this moment in history? This question is, of course, much on the minds of Americans of voting age these days. The future is not yet written. The votes may or may not be counted. They may or may not count. However, at least to some degree, the future is ours to compose. Some of the major struggles before us are clear. Among the principal challenges of our generation is the imperative to manage the adverse consequences of the powerful technologies we have created. Among the most dangerous of such technologies are nuclear and biological weapons.

Biological weapons are in the world. Let us be clear: the efficacy of these weapons and their ability to kill large populations have been known for decades and demonstrated persuasively by all possible means short of their use in war or an actual bioterrorism attack. What has been largely overlooked in the complaints about the lack of a quantitative threat analysis, and in arguments about how many microbiologists a terrorist must know to build a truly scary weapon, is the trajectory of biological science in our time. To reiterate what George Poste said, we are on the threshold of the age of "big biology." The momentum and pace of this Cambrian explosion of biological knowledge are prodigious. As our understanding of molecular biology expands, as we develop the ability to manipulate cellular processes, we will also inevitably create the tools to build more varied and more powerful biological weapons. At the same time, the widespread use of biological science and market forces will ensure that the techniques needed to exercise this knowledge will become simplified and more widely accessible.

Consider, for example, the effort underway to derive infectious influenza A virus from viral complementary DNA. This has been chronicled in prestigious scientific journals for the past year or so, and the work has progressed to the point that infectious virus can be generated from only eight plasmids. A year

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ago, a minimum of 17 plasmids were required, and earlier methods of producing the virus from the cloned DNA were far slower and more cumbersome than today. These methods are a great boon to researchers struggling to thwart another influenza pandemic. However, this work has a very obvious dark side. A senior researcher concerned about the implications of this achievement and the relative ease with which an influenza might be crafted wrote the Johns Hopkins Center for Civilian Biodefense Studies and noted that the current joke among molecular biologists is "not only can a high school student construct such a weapon, so can the janitor of the school."

Those who are bothered by the lack of quantitative threat estimates for deliberate epidemics should also consider that the risk from natural epidemics of infectious disease is increasing at this point in history. Why is this? An increasing proportion of the world's 6 billion people live in large cities. Before 1950, only London and New York had populations of more than 7 million. Now there are more than 15 "megacities," which harbor more than 15 million residents apiece. Half of these are in the developing world where poor sewage, overcrowding, inadequate nutrition, lack of clean water, and living conditions that place humans and animals in close proximity create almost ideal environments for breeding harmful pathogens.

The forces of globalization offer efficient conduits for the spread of disease. International transport of people and goods by jet is routine. In the 1918 flu pandemic, it took 4 months for the virus to circle the globe. That was in an era of cargo ships and trolley cars. Today a deadly virus or bacteria can traverse the planet in a day. Globalization has also created vast food distribution networks, which allow widespread dissemination of tainted products and greatly complicate efforts to prevent contamination. Further, the pressures of population growth and commercialization have fueled human intrusion into once remote ecosystems, increasing the chances of contact with previously unknown and potentially dangerous viruses and bacteria. Finally, the natural evolution and mutation of microbial pathogens, abetted by imprudent prescription practices and inadequate public health, have ensured that drug resistance must now be factored into strategies to contain infectious disease.

All of these factors present a context that demands urgent attention to the perils of biological weapons and epidemic infectious disease. If we awaken to where we are and where we are headed, if we take prudent steps to manage the technologies we have created and the conditions we have made for ourselves, we may forestall the most calamitous bioweapons scenarios. However, this moment of relative calm and prosperity we now enjoy will not last.

In the past two years, much has been accomplished. The Department of Health and Human Services has assumed a leadership role in preparing the nation to respond to a bioweapons attack. The Centers for Disease Control and Prevention (CDC) and the Office of Emergency Preparedness have initiated critical programs at the state level and provided essential support for the beginnings of state response infrastructures. These efforts are incomplete and imperfect. This is natural, as Richard Falkenrath pointed out, whenever one tries to create large, complex programs. Of course, much remains to be done.

There are seven issues related to bioweapons preparedness, response, and prevention that I think are in need of particular focus and investment. First, government investments must be commensurate with the threat. In this country, elected leaders show their seriousness about an issue by the way they talk about it and the amount of money they spend on it. If biological weapons constitute a serious national security threat, we should be investing some serious money in this problem. The customary number given for chemical and bioweapons defense expenditures in Fiscal Year 2000 is $1.4 billion. In health terms, this sounds like a significant amount of change. However, seen in the calculus of defense spending, this is peanuts. That, as Amy Smithson pointed out, we are devoting only 0.0046% of the $260+ billion defense budget to ensuring that the talents of bioweaponeers from the former Soviet Union are directed toward peaceful ends is telling and inexcusable.

In addition, to demonstrate its commitment to take the biological warfare (BW) threat seriously, Congress should appropriate funds for the Kennedy-Frist Public Health Threats and Emergencies Act, which authorizes up to $500 million in spending to improve public health infrastructure but does not yet have money attached to it. We need an appropriations bill.

Second, we need a very significant biomedical research and development program. We need a focused, fast-track effort to produce new vaccines and drugs, especially antiviral agents, to combat the most likely bioweapons threats. We need to develop technologies that enable rapid and reliable lab diagnosis of BW pathogens. In the longer term, we should take on the growing problem of infectious disease and, in collaboration with international partners, try to develop ways to enhance immune resistance by more elegant and multipurpose means than the one-bug/one-drug approach. We need, in short, a Biomed Apollo Program. Apollo, you may recall, was actually the god of healing.

In the first "nuclear age," to use Professor Bracken's phrase, we went to the moon. In this era, let's find out what planet Earth would be like without malaria or AIDS or the threat of a big bioweapons epidemic.

We should create a research and development map for such a Biomed Apollo Program that charts where we are and where we want to go. Creating this map should be the responsibility of technical agencies in government with strong input from scientists from universities, pharmaceutical companies, and the biotechnology industries. As Amy Alving demonstrated, it is very important to have a clear analysis of what we want to accomplish when we embark on a search for new technologies. If you don't have a clear understanding of the functional requirements of what you're trying to build, you'll end up funding a lot of sensors that don't work outside desert environments.

Third, several items need attention, all of which pertain to building integrated systems or organizational networks or making key institutional connections. Many commented on the institutional fragmentation that besets numerous aspects of current epidemic response, among them problems linking local, state, and federal efforts; problems connecting multiple hospitals into a community-wide network; disconnects between medicine and public health; and the disengagement of physicians from preparedness efforts.

These problems—of institutional connectedness, of creating new systems—have to do with changing or building organizations. This is important work, but it is very hard, and it is going to take time and persistence. We need to realize this so that we don't get discouraged.

I want to highlight some suggestions for creating organizational change and building such integrated systems before I proceed to a discussion of the actual projects. Jim Bentley, John Bartlett, and Laurie Garrett cautioned us on the need to pay heed to the social values and needs of the communities with which we're trying to interact. For example, hospital staff will need assurances that their families are being cared for if we want them to show up at work on extra shifts. Doctors are mostly likely to pay attention to messages from other doctors. We need to recognize that members of the media have important jobs to do that deserve respect and carry their own demands. Martin Hugh-Jones observed that the success of ProMED-mail was due at least in part to the accountability and transparency that were built into the system. The importance of building dual-use systems was mentioned many times. This is critically important in constrained budgets, and all budgets are constrained. We need to look for opportunities to build systems and find solutions to bioweapons response problems that also serve routine organizational purposes. Public health management of West Nile virus and the broad societal benefits from biodefense research and development are examples of dual-use applications.

Things usually look like a muddle in the middle when you're involved in complex projects. Richard Falkenrath cautioned us that it's normal for new, complicated programs to take time to become established. D. A. Henderson reminded us that the smallpox eradication campaign at its midpoint had generated much energy and excitement, but he couldn't tell yet if it was going to succeed.

We have to have courage. We have to realize that creating an integrated biodefense capability is going to take time. We also have to have some sympathy for and be generous toward those who are trying to make these difficult organizational changes happen. Keep this in mind the next time you approach a federal or state official and explain to them what they are doing wrong or have not yet done.

So with those organizational building principles in mind, the following is a discussion of, in my opinion, the essential systems-building and critical-connections projects on which we ought to focus.

We must first repair the medical-public health interface. As Marci Layton pointed out, strong relations between clinicians and public health professionals are essential to outbreak detection. The West Nile virus might never have been discovered but for a concerned infectious disease doctor who called the New York City Department of Health (NYCDOH) and a very competent public health professional who answered the phone and took action.

Next, we must focus on creating a robust electronic system for tracking and managing disease outbreaks once they are detected. Marci also noted that managing the huge volume of information coming in to NYCDOH during the West Nile virus outbreak was the greatest challenge they faced. I am very wary of spending scarce resources on ambitious and expensive efforts to invent elaborate surveillance systems for purposes of detecting BW attacks. We need to try to do this, but we should proceed cautiously. As Jeff Koplan said, many public health professionals at the state and local levels don't have computers on their desks. Let's at least get them plugged in to computer networks that are comparable to the ones their kids are using at home before we try to build the great electronic surveillance system in the sky capable of finding bioweapons needles in haystacks of background noise.

We should also build surge capacity in hospitals and health care facilities. The goal is to create com-

munity-wide response networks designed to accommodate mass casualties brought about by deliberate or natural epidemics and other natural disasters. This will require, first, money to allow hospitals to do some planning. To start, we might consider competitive grants to develop practical templates for an intra-institutional response. We could also develop some grants for consortia of hospitals, health maintenance organizations, and health departments to look at ways of integrating multiple facilities into community-wide or regional response networks.

Ultimately, we're probably going to need a suite of incentives and possibly regulatory penalties to create the medical surge capacity and response network that we need. Some aspects of this may be truly expensive, and we need to be very careful not to put another unfunded mandate on top of the financial pressures with which hospitals are already struggling.

Next, we need to invest thought and resources in approaches to containing contagious disease. This is a very complex set of issues. We are still in the consciousness-raising stage here and just beginning to scratch our heads and figure out what the heck are we going to do and how are we going to do it.

Last, regarding prevention, I mentioned that we have to find ways to support bioweaponeers in the former Soviet Union in their quest to earn a living and use their talents for constructive purposes. I have not heard of or read any plan for international control of biological weapons that compares in boldness and coherence to that put forth by Ambassador Butler, and I urge that we strive to get his idea of making the development or possession of a biological weapon a crime against humanity considered and discussed at the highest levels of as many governments as possible.

Even these few elements of the biodefense program that I'm suggesting as priorities are ambitious undertakings. The whole catastrophe of biological weapons is immensely complex, clearly beyond the ability of any single organization or institution, or even an entire professional community, to shape or control. Researchers from multiple disciplines, public health practitioners, clinicians, government officials, and people from academia and industry from many countries and international organizations will have to participate if we are to successfully manage the problem of biological weapons. Each of us must do what we can, in ways we judge proper. We cannot wait until we have finished some master plan before we jump in. We must not get discouraged by the weight and the complexity of the task.

So here we are, a moment in history when the world is struggling with what to do about biological weapons. Those of us who are well fed, well educated, and free are among the most privileged people on the planet. What remains at the end of the day is to answer this question: A year or two or ten from now, what will we say we did about biological weapons, one of the greatest threats of our era? I am hopeful that our answer will reflect honorably on our efforts.