National Security for the 21st Century

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Q: How likely do you think it is that a biochemical terrorist attack will happen in the U.S. in the next five to ten years?

H: Of course, one of the major focuses is that chemical biological weapons are relatively easy to make and they're relatively inexpensive, so they would seem to suggest themselves as natural weapons for terrorists to use because of the ease of making them and the inexpensiveness. On the other hand, it seems to be difficult…for terrorists to get good information about … how to make these weapons but particularly how to disperse them, how to disseminate them once they're made, and that's often a weakness in terrorist attacks that have been attempted to date. So it may not be as easy as it appears on the surface to actually take them out and use them for these purposes.

L: Of course, most of the people I've worked with on these issues think there's a very high probability of this happening, indeed the tests have already…there was a biological attack out in the Dalles some years ago. Assessing the probability of something like this….involves also assessing the scale and magnitude of the attack. It's a virtual certainty I think that there would be some at least small scale attack. Now whether there will be something on the scale of the Tokyo subway attack … it's a little bit more difficult to assess. I guess not over a 50% probability of five to ten years away.

Q: Now, several things I've been reading, some of the reasons that experts say that it hasn't happened already is, one is that it's hard to push an agenda when you cross a certain line, when you violate the moral precept that the species doesn't attack itself with a species threatening illness, and that might be one reason that something like smallpox or the plague has not been released on the planet. Another is, of course, there aren't a lot of success stories. I don't think that anyone considers the Tokyo incident as conspicuously successful, and the Dalles incident was successful but it was a small scale and wasn't, you know, it didn't kill anyone and didn't attract the attention that it might have. So there's not a record of success. And then a third [reason] is simply that the terrorists might be afraid of self-infection. These aren't visible substances, like a bomb. What do you think about any of those? Do you think any of those are going to mitigate the likelihood of an attack?

H: It's very hard to tell, you know, with respect to issues like species survival because those factors would almost seem to be unconscious or subconscious in operation. So how do you know? With respect to people worrying about infecting themselves, being careful particularly with biologic agents, that's certainly a consideration. I mean, even if we look at historic [incidents] like the creation of smallpox epidemics by the Spanish conquerors and the British army and the Colonial wars like the French and Indian wars, that was the thing they were always worried about when they were starting attacks like this. So yes, definitely, that's a concern.

L: There's been a troubling trend in terroristic attacks in recent years. The people who perpetrate them are no longer claiming the credit for them now, including not announcing

[an] agenda…they're just doing it for sheer harm. And that tells me that the risk [of self-infection] is not as important.

Q: An attack with a biological weapon, that kind of segues into the next question. In an attack with a biological weapon that was unannounced with a pretty devastating effect, particularly if it was a species- threatening or highly virulent [disease] like smallpox or the plague, the likelihood is… Most [victims] present with flu-like symptoms, and the likelihood is that first responders could be anyone from your school nurse, mom dosing a child with aspirin, up to the family doctors and the emergency room physicians. Is there anything to be done to contain an outbreak like that? And also, of course, the victims are going to scatter. They're going to be on planes, they're going to be on trains, they're going to be in automobiles. Are we just going to take a massive hit, even with the preparation we're doing now? Is there anything we can do really to prepare for something like that or if it's unannounced we'll just simply take a massive hit and learn from that?

H: Well, I think you're right that one of the big problems with a biological weapons attack as opposed to a chemical weapons attack is the delay in apparent symptoms. For chemical weapons, the symptoms would occur fairly rapidly and people would be in the area where the agent was released and where they were exposed to it. But with biological weapons, there could be a delay of up to days, maybe over a week. Again, certainly some of the initially presenting symptoms aren't that serious or aren't that specific. The flu-like symptoms are thing particularly of concern with anthrax, because initially for many cases it will look like a mild upper respiratory or flu-like illness and by the time it gets to the point of getting specific, then it's really too late to treat it effectively. Things like smallpox have some delay before specific symptoms appear. Like you said, people can spread out from the point where they were exposed. In fact, they can get on planes and go almost anywhere in the world, and then with some of these things that are actually contagious, like smallpox, that can tremendously multiply the problem. Probably our best hope of doing something that's preventive to mitigate the impact of an attack like that is much wider awareness timing because most physicians out there, most emergency responders, most …emergency rooms aren't familiar with how these things present outside of the context of chemical and biological weapons of terrorist attacks, so they're saying, "Boy, these are really exotic diseases," and they almost never see them. And so they don't get a high index of suspicion for them. They don't know what to look for, so making them more aware of what to look for and perhaps having a surveillance system where things that might begin to look like an attack with a biological weapon are reported to a coordinated centralized area may be our best hope of dealing with an incident like this.

Q: Would that be the issue for something like anthrax? Because my reading of anthrax, and I could be wrong, but my reading was that, you know, it's really almost impossible to tell until it's progressed far enough along, so you would really have to see a major outbreak of flu-like symptoms at a time when the flu season's over, or something like that. There would have to be… I guess you would have to have some sort of pattern to be looking for and coordinating with, or you'd have to have detectors that detected patient exhalations and detected anthrax — which is kind of far-fetched…and rather expensive.

H: Yes, I don't think that technology exists in a way that's at all validated or that can be dispersed easily or in a cost-effective fashion. And you've got anthrax up to the point where…almost to the point where it's impossible to treat it, it's going to be non-specific. Even with a surveillance system, it might be difficult to recognize a pattern that suggested

a biological weapons attack other than just a normal outbreak of another virus type of upper respiratory infection…something that is common, but not a biological weapon.

L: The variability of incubation period and the time between first symptoms and severe symptoms is a little bit of slack as we could use to mount the defense. I think the general consensus is that if a competent anthrax attack were launched, and I wish to put emphasis on that word "competent" — it's awfully easy to botch an attack of anthrax — we would have some people who had either died or progressed beyond the point where we could successfully treat them before we recognized what we were dealing with. But the first people to die would help warn us, and it is likely that there would be a fairly quickly recognition — within a day, probably less — of what was going on. We could still defeat it…We could have significant mortality, but it won't wipe out whole cities, in all likelihood. Something like smallpox, you've got an average twelve day incubation period with a range from seven to about eighteen days. Not everybody who gets it will die, but …the survival rate …is not something we'd like to think about a lot of the time. We do have some drugs now that are not stockpiled anymore, but there are some drugs that would help. There are some — older folks, particularly — who have a little bit of immunity left, but we still do worry about that in propagating. Anthrax, of course, doesn't propagate person to person, and that will help us tremendously dealing with an outbreak.

Q: There was a May '99 article in JAMA by a panel of doctors, and high-level public health experts who issued a consensus report on how to deal with a recognized smallpox outbreak, and what they basically said is that vaccination could not really successfully be brought to bear and probably shouldn't be, but there might be focused vaccination…and quarantine. But when I think about quarantine, unless we really know a lot more about smallpox, because again, it can present in a flu-like way, unless we know…unless we're really expecting it, do you think we could successfully quarantine people quickly enough in a city like Atlanta with the second busiest airport, where people scatter? Would it be too late to quarantine folks?

L: It's never too late. And in fact, even in India when smallpox was a ongoing epidemic problem there, they used quarantines and vaccination of people in the surrounding areas to contain outbreaks. That's basically how they got rid of it. And it can work in this country, and there will be disease and injury if it gets loose in the country. Again, we'd contain it eventually.

Q: Well, we haven't had a smallpox outbreak since forever almost, and the same is true with the plague — our last one was in the '20s in LA — yet there are countries where those have been fairly common and continue to be fairly common….Would there be any benefit from knowledge sharing between some of those countries? There are physicians who have seen — like you say, in India — who have seen smallpox. And yet I suspect that most physicians in the U.S. have not.

L: That's true.

Q: Is there any information sharing going on, or would that be really beneficial--an exchange?

H: I think that would be very beneficial, and I think that kind of gets to the area we were mentioning earlier of awareness training. Because these aren't diseases that U.S. physicians probably see, more basic training in what these diseases look like, more awareness of the possibility that these things could occur in a terrorist attack, so they might be seeing something to raise the index of suspicion of looking for these types of problems, thinking about them could…would be an important part in our response to them.

Q: Okay. There is a tremendous amount of expertise available out there. A lot of it is, as I say, in developing countries where they actually see these cases, and it would be really beneficial, I think, if someone were videotaping some of these cases and sharing them… There's also a lot of expertise at the policy level, USAMRIID, CDC, and also at the testing level. But I haven't gotten the feeling that there's good coordination. There's too many people that have too many little pieces of the puzzle, but there's not enough coordination to put an entire puzzle piece together, particularly when you're in a hurry. Is that your sense, and if it is your sense, then what can be done towards that?

H: I think you're right. I mean, I think there's a lot of good information out there. The information exchange resources are much better now, you know, with things online, with telemedicine and video conferencing, but I don't see a lot of centralized coordination of putting these pieces together, and that could be tremendously beneficial. It would make it easier, too, for physicians who have all kinds of things to continue to be educated in, to make that a target for continuing medical education, and could we make it a priority? Because it's too hard when you're very busy and you've got all these things to continue to be educated about to pull that together on your own, so if someone were focusing and centralizing, I think that would help a great deal.

L: Yes. In terms of coordinating activities among the various levels of government, I think the greatest difficulty is going to be getting down to the local level. Our general assumption in dealing with an [attack], which is my background, was that the community would tend to stay in place for at least six hours. Now, there are [response] teams that have a mission requirement of a maximum of two hours between alert and wheeling up at the nearest airport, but if it takes 45 minutes for the local community to realize it has an emergency, two hours to get the Marine Corps [assembled] for the Army's technical escort and then it also provides assistance, say an hour and a half to fly to whatever destination they're headed, get on the ground, get to wherever they're going to do their work, that's going to be the better part of six hours before any help can arrive. And so really that was one of the bits of genius, that the Nunn-Lugar-Domenici Bill had put resources to the community level where it's most desperately needed.

Q: My background is technology and I've been recently involved with digital video, so I know that the medical field has really embraced telemedicine, and it's the rare medical school that doesn't have a telemedicine outreach to rural hospitals. …So one thing I'm wondering is…can this component be [utilized] Right now, [its use] of course is talking people through [procedures] and interpreting X-rays or CAT scans or MRIs, but…it would be invaluable for helping to diagnose outbreaks.

H: I think you're right, and I would like to see more of that happening. That would be a tremendous contribution to awareness training. It does kind of involve a bit of the squeaky wheel gets the grease idea, though, that, you know, physicians are spending their time on the things they see, and because there really haven't been incidents like this, they haven't seen this sort of thing, it assumes a lower priority for them. But if there were programs that were better put together, better focused, I think that would raise their level of interest.

L: My own take is that that's probably best put into the awareness of the continuing medical education before the event. At the time things start happening, you're going to have paramedics and emergency medical technicians in the field, not close to a conferencing center, you're going to have ER people who are suddenly…inundated with patients.

They're not going to want to take time out at that point to go see a conference. Now, it could be helpful… As you mentioned, there are very few physicians in the United States practicing now who have ever seen a case of smallpox. If you had a case like that in a remote area of the U.S., then sending images to the CDC, where there still are a few people who've seen it, other places where there are a few people who've seen it…

Q: Should the CDC and agencies like that be very aggressive about bringing doctors from developing countries that have actually seen and treated this diseases over to provide expert assistance? I mean, I'm worried that, you know, in ten years, even those doctors will disappear, if we don't have an outbreak. And yet they are a resource that's out there.

H: You're thinking, for example, of smallpox, where we haven't seen a case in many years. You know, it would be a good time to start getting some of the physicians of [these] cases together and making them part of this overall effort to build awareness training, to build a coordinated resource. Yes, I think that's a very good idea.

L: It would take a whole lot of effort to do a fair amount in that direction. There are so many different things in addition to weapons of mass destruction that are crying for attention…

Q: So how important is it to develop this communication infrastructure? Is that the primary need in medicine right now? You've got doctors that understand how to do prophylaxis, how to treat, but they need to know what they're treating. Is that the key piece that needs to happen first is being able to recognize and look for… Or is it the key piece at somewhat of a higher level, the epidemiology level, the need to be trained to recognize that this is strange, this isn't the flu; something weird is going on — or both? Are those the two key pieces that are missing right now for the medical side?

H: I think part of the key to the system is both a good surveillance system that would recognize a pattern in cases coming in that might suggest particularly a biological weapons attack. I think a chemical weapons attack would be recognized much sooner because the symptoms would appear more quickly. In addition to that, I don't think physicians out there in addition to not recognizing these diseases that in their experience is more exotic, I don't think they all have a good awareness of how to treat them. So I think training and awareness of treatment as well as recognition is also important. And just getting it, again, up on their list of priorities, you know, where they think it's important enough to spend some time on. Because really they don't see it that often. I think that's very important.

L: The first person to recognize an outbreak may not be a physician — it might very well be a triage nurse in a hospital emergency room, it might be an ambulance dispatcher who's sending dispatches to several hospitals around the county. We need to get a lot of people trained to recognize something unusual coming down and bring that, then, to the attention of somebody who can assess it.

Q: Now, as part of that training in recognizing and responding, there's another expert group, a little bit controversial, but this is something that Senator Nunn feels fairly strongly about, and that is the Biopreparat doctors. I've heard estimates between 50 and 60 thousand of them, and that most if not all of them are in fairly desperate straits. I've also heard a rumor that some of them are continuing their work. Certainly we're not allowed to check to see if that's true or not. There are two possibilities. One possibility is to actually convert some of their labs, some of their many labs over there, to research facilities, but others urge us to bring some of those folks over here to provide us with the [knowledge] and training. Is that a good idea or is that a dangerous one?

L: I'd like both ideas implemented to varying degrees. They have the considerable capacity for good quality research there. There's some debate about that. It was defended here. There are detractors that think it's not good. But what I've seen it can be really good. Since it would be economical — right now they work for very little pay — I think [both] using their facilities … and bringing people here.

H: I would agree, and I think importantly it's, for example, there are the things Dr. Alibek [revealed]. They actually made great progress in coming up with a number of weaponized agents that we have very little experience with and knowledge of, so they can be a tremendous resource in providing us information that would be very hard to come by in other ways.

Q: It would also be to our benefit to have them gainfully employed and not seeking employment in places like Iran and Iraq, so what about some of our other illnesses? I mean, they've done a lot of genetic engineering research. What about having them look into gene therapy for cancer treatments, for HIV — would that be dangerous or would that be a good thing?

H: I think certainly if they were working for us as part of the medical research community as you're suggesting, their expertise would make them a really valuable resource in a lot of work that we're doing in other areas. We're beginning to, you know, understand the genetics of various kinds of diseases — cancer and other diseases. They could be a tremendous resource.

Q: What about something like HIV? But I think if HIV were ever weaponized, and to my mind

weaponizing it would mean that it could exist outside the body for longer than the brief period of time that it exists and if you could be infected via aerosol. That would be weaponized HIV, potentially a species wipe out. So would it be dangerous to have them working in HIV?

H: HIV could, if you could do those things, yes, it could be a very dangerous thing. I think, though, some of the features of HIV that you're alluding to are things that would make it not a good candidate for a genuine biological weapon. It's very fragile. It doesn't survive well in the environment. It's not one of the more contagious infectious agents — it takes a relatively large number of HIV particles to set up an infection. So it's probably not a good candidate for a biological weapon in the first place — fortunately.

L: It doesn't produce disability quickly. [Many years may pass] before victims are incapacitated. All the reasons it would be unattractive as a weapon.

Q: So we could safely involve these Russian scientists in fighting some of our standard diseases — and also drug resistant viruses. I mean, they should be very good at helping us combat what's going to be a very serious problem for us in the next few years.

H: I think some of their knowledge and expertise is just information we don't have and couldn't easily come by from other sources, so they could be a tremendous resource for us.

L: These folks are not by temperament inclined to produce weapons of mass destruction. They've been doing what they thought was their patriotic duty. And I don't think we'd have to worry about them [doing bioweapons research] where they had alternatives.

Q: One of the things that can be kind of scary, certainly when we had the encephalitis outbreak this past summer in New York, a lot of effort was put out by the CDC and others to say, "This is not an attack." And people were very concerned; it seemed to be not an endemic disease to New York. There was a fair bit of panic. So an issue that can be

troubling that arises is if you have an outbreak, if you have an attack, a biological weapons attack, the panic that people are going to experience, the wanting to flee the attack area which might be dangerous to the rest of the population. And you know our country is founded on the idea of freedom of the press. How do we weigh that?… When a president is shot or a president has a physical, the doctor has to go out from Walter Reed and say, "The President's fine," or whatever, and he has to be very careful what he says, that it doesn't violate the confidence of his patient. So it's frequently the physicians that have to be out there calming the public, that have to say either it's okay or it isn't. So how do you feel about freedom of the press? How do you know when to…what's too much to tell? How do you weigh even having to lie or obfuscate so that the public doesn't panic?

L: My own take on that is that the public is generally quite reasonable if there is information with which to be reasonable. I think we would err more by trying to withhold information than by trying to let out information. I think telling them what is known and what is not known, they'll by and large respond in a reasonable manner…If you withhold information, the public will eventually [discover the truth], and that does terrible things to their confidence in what you do or don't do later.

Q: I guess, was it last year or the year before that the two anti-virals for Type A flu showed up, and that's kind of, you know, an exciting development for flu sufferers. w e're not going to be able to vaccinate everybody. It's too dangerous to try and vaccinate everybody against the 40 or 50 possible weaponized diseases that are floating around. Should there be more research in the area [of antivirals]? Is that a promising thing that we could use to inoculate sort of people after the fact if an attack does happen? Is it a possible way of preventing smallpox or other viral weaponized diseases?

H: I think it is very promising, and I think generally we should be putting effort into finding anti-viral agents, not just for biological weapons preparedness but for general clinical reasons. But we historically have a much harder time coming up with anti-viral agents than we have with anti-bacterial agents. They've been very slow in coming for quite a number of reasons. They're much harder for us to develop, much harder for us to get approved for safety and efficacy and out there on the market for use in clinical settings. So if we could develop them, certainly they would be great. But keep in mind that not all the biological weapons use viruses. Many of them are bacteria, many of them are toxins and other biological agents. So certainly they'd be helpful against the ones that are viruses, but, you know, there are a lot of other agents to worry about, too.

L: Something for all kinds of viral illnesses in the community, and I think most of the research in that will be done by the pharmaceutical industry without any particular prompting or reference to weapons of mass destruction concerns. A few probably would benefit from specific government intervention and [allocated] resources. There isn't a whole lot of interest in the private sector in developing drugs that will combat smallpox, for example. It doesn't exist in the wild. And unless it gets out, there's not going to be a problem with it.

Q: We used to have a lot of successes in vaccination, and vaccination's a possibility for viral attack. And we used to have a lot of success in that — the polio vaccine was invented by us — but we had a major debacle not too long ago…and that was the swine flu [vaccine]. The [swine flu] was perceived as an enormous threat — the 1918 flu all over again. It was hyped as lots of people are going to die if we don't do this, and the manufacturers were very concerned and said, "You're not giving us enough time, so you're going to have to bear any [liability] hit." And the hit was… Because of Guillain-Barre syndrome and

because of a few deaths, the hit was pretty significant. So what I'm wondering is, could we even gear up? This article in JAMA in May of '99 said 36 months minimum to gear up to do any kind of vaccine preparation for smallpox. Could we even…is it even on the cards to do vaccinations? Could we even gear up for it, and could we even afford to with the…when you have that bad precedent now that says the federal government's going to take all the hit from any side effects, any problems?

L: I think we couldn't afford not to, if it actually came to that. We do have some smallpox vaccine still in reserve — not a lot, unfortunately — and I don't know whether its efficacy has been tested. There was a good reason, of course, why we stopped giving smallpox vaccination, even before it was eradicated worldwide. We were killing more people each year with smallpox vaccination than there were cases of smallpox in the United States, for quite a number of years. Indemnification, the government pays the costs if there are bad effects from this I think is likely to occur…but I think we'd have to do it. There isn't much choice.

Q: Well, if it takes 36 months, should we be doing it now, then? And how do we compel the pharmaceuticals? I mean, they don't…I'm sure they all shiver when they think "swine flu vaccine." They look bad, even if they don't have to pay. Can we compel them to do it? Is this a goal for Biopreparat… ?

H: I think that actually in practice these programs often take less time than these projections that sound so long, and when we actually get into responding to a situation like this, we do it much more efficiently. It happens much more quickly overall. One of the things you also, I think, have to consider when you're talking about weaponized biological agents, and [that is] how genetic engineering could have been used in preparing these weaponized agents, there are many ways that agents can be altered to avoid or circumvent the usual immune system response. So with a vaccine, in the vaccine preparation there may be something of a guessing game where you're not dealing with natural smallpox, but you're dealing with some artificially modified type of smallpox, as to whether the vaccine you have prepared will be effective, and those are things that would also have to be addressed. So that would I think make the issue a lot more complicated. I think it would take perhaps a large national effort to get up to speed, get up to the level of where they need to be. It certainly looks like a risk that should be addressed given the things we hear from people like Dr. Alibek about the Russian efforts in weaponizing smallpox, altering it and the amounts they produce, the amounts and types of it that may be out there.

L: There was one source in the United States for anthrax vaccine, Michigan State Health Lab. They decided they did not want to continue in the business and their facilities have been bought out by a private consortium with government sponsorship. The people who did that are retired military people and they undertook that out of a sense of patriotic duty. I think they could be counted on in an emergency to [respond with] such resources as they have behind them. And second, you've got to remember that the smallpox vaccination's been going on for a long time. It goes back to colonial days. You can do it in a very low tech way. You can take fertilized eggs, inoculate them, and harvest from the ____ membrane and have a viable vaccine. So I think we could do it if we had to.

H: That's true. Even George Washington and Napoleon had their troops immunized for smallpox.

Q: Oh, yes, variolation actually goes back to the Chinese to like 500 AD or something. And also, it's interesting since the smallpox vaccine is actually cowpox—vaccinia-- you know, there is some hope that even if people have different strains, the antigen response is not quite that specific, so that's one advantage of smallpox. Dr. Alibek's been very interesting, and he had some interesting ideas for what we ought to be doing in response to bacterial weapons. He seemed to feel that one of the big problems was that it is hard to maintain an immunosuppressant effect in the lymph system and so he suggested that we need to do research in that area, find ways to increase and maintain a concentration of antibiotic, and also find ways to inject directly into the lymphatic system. Can you comment on any of this?

H: Those are all good ideas, and, you know, with most research efforts it takes getting into it and defining what are the important factors, then being creative and coming up with creative problem-solving approaches, and you never know that they're good and they're going to work until you actually clinically test them and test them in the real world. So I would say certainly at a theoretical level those approaches make a lot of sense, and I think they'd be really promising avenues to pursue, and hopefully you can come up with specific technological based [development].

L: And that would be helpful in treating illnesses other than those brought on by deliberate attacks… We have a few cases a year of the plague and it would be helpful to be able to bring extra technology like this to bear on those cases.

Q: You know, one of the problems we bump against, of course, is that — I guess it's probably in the last 20 years that we've really clamped down very hard on human subject testing. And that's a fairly recent conundrum, since the '60s anyway, and early '70s. So could we even do this kind of testing quickly enough to be useful? I mean, in the long term, like you say, for all kinds of illnesses it could be useful, but it almost seems like the research itself, you know at the cellular animal level, would be quicker than the…all the permissions and the hoops you have to jump through to test it on humans.

H: Many of these issues could be addressed to a large extent at a basic level, at least in some cultures, using animal systems, using various types of laboratory testing. But of course ultimately, as you're suggesting, we would have to do human testing, particularly at the level of testing efficacy, making sure that whatever creative strategies you came up with, to implement these types of things like whatever reach you could come up with to make sure that anti-viral levels were high enough in the cells or anti-bacterial levels were high enough in the bloodstream, could those actually work like you expect them to work. At that point you would need to human test. And again, I think, you know, it kind of is suggesting drifting toward a rather intensive national effort that would really be needed to address some of this research approaches, as with the effort that would probably be needed to get up to speed with smallpox vaccination.

L: With anthrax [prophylaxis], you also could not be able to do it. I can't conceive of a time when we could give a human volunteer a combination of things that we thought would protect him against anthrax, then sit him in a chamber [exposed to anthrax]. I can't see it happening soon at all.

Q: I hope not.

L: We had tested the humans in other settings… we could get some sense of the [response] dynamics, but the acid test, I don't think we'd do it.

Q: Well, the acid test may be if we get to that point that [we've been exposed already]. I suspect that while I'm not going to sit an aerosolized chamber with aerosolized anthrax, if I know that I've been exposed to anthrax and you needed a volunteer, I'm there. So I suspect the volunteers will be the first people to be attacked by the attack weapon, and I don't think you'll have any shortage of volunteers then. One thing I'm wondering is most of my research indicates that the heavy interest is in the U.S., and that's what you'd expect because we are the last superpower, and you know we are the ones that face the asymmetric attacks, we're the ones that people…primarily they wanted to attack us on foreign soil, but they're still attacking us. We are the target of terrorist attack predominantly, but we're not the only ones. Is there much of an international effort? We need a lot of minds to bear on this.

H: There's certainly not a well-coordinated international effort. I think a number of countries are beginning to address these issues. For example, we were involved a few years ago in assessing the level of preparedness, and not only in the United States but in some other countries, like Japan and Germany. And they are starting to think about these questions. There are some technological research activities going on, but there isn't a well coordinated central international effort.

Q: How important is that? Can we do it on our own?

H: I think it would be very helpful the more coordination, the more sharing of information, the more combined effort because of the victim dispersal we've been talking about. Some of these questions to be addressed effectively would require a fairly large centralized intensive effort, and the more help there was with that, the better that would be.

Q: Now, we talked about the fact that detection systems probably wouldn't be that useful in hospitals. For one thing, if you're in a hospital and you have a dozen people rushed in with whatever illness, you're not thinking about how to turn on the detection system and it's going to be so confused, you know, you're not going to trust your readings. Is there anything that we can do to stop the cultures and recognized diseases from being brought into the U.S.? Is there anything we ought to be doing at border crossings and entry points? Or is it too much?

H: Well, the good technology doesn't exist, for example, to, you know, have a warnings detector that would go off and say, "There's a biological weapon in there," or "There's a chemical weapon in there." There are issues I've mentioned in developing technology that will detect some of these agents as they're released, like if they were released at a large sporting event or a large public event. But then with the biological weapons where there's some delay between the exposure and the appearance of symptoms, if you don't happen to be in the right place with your detector to catch it as it being released and your next best chance to pick it up is going to be people at the level of treatment or emergency response recognizing what they're dealing with, so then you're getting back to really one of our most effective means of preparedness is basic awareness training. And also, if we can put it into place and figure out good ways to recognize patterns that might suggest these sorts of attacks --a good surveillance system.

L: Detection for chemical agents at the emergency room level is probably not…going to be pretty much done immediately. Now, there are some interesting developments including some here at Georgia Tech in what may become a relatively low cost dependable detections that do not require a PhD to run them. And that could then be useful. If you

could develop devices that would be good for things besides weapons of mass destruction, that could be very useful. There is for example work done at the Chemical, Biological and Defense end of the _____ of developing techniques to use mass spectroscopy to identify biological agents. Certainly that can already be done with chemical agents. They were developing libraries of mass spectra that would help identify the number of their coordinates. If we could get to the point that we could take a throat swab, run it through such a device, and know whether that was diphtheria, strep, what strain of strep, and so on, it would be very useful for a lot of things besides weapons of mass destruction, and it would be used already, hospitals would not have to pay for it, they wouldn't have to pay and they could keep it.

Q: So what we need then, though, is we need high speed reliable high bandwidth internet connections so that we can share the spectrum across the internet so that…because everyone can't have this library resident in their hospitals. So anything…any sharing like that is going to require good reliable networking.

H: It is, but even more basically, the basic recognition technology right now doesn't exist in the first place. So that very much needs to be developed. And then at the point that is developed, I think you're right, a high bandwidth widespread sharing of information would be needed to facilitate it into useful information.

L: Bandwidth on CD-ROMs. Impressive.

Q: That's true. We could do it on CD-ROMs. Then the other issue is how does the government fund this? …It seems like most funding is going into response preparedness to first responders right now. Should more money be going into high level research so we could have research in some of these areas?

L: The emphasis was on the most acute need--the first responders. We were not prepared at the time of the Tokyo event to deal with events like that in most cities in the United States for the purpose of preparing responders and supplementary prepared sites. And I think there was a sense that we needed to get at least something in place quickly to help with that. As we approach success in that part of the program, I think there will be a need to look at basic research to get further down the line and some of the backup systems we need. And it'll happen, I think.

Q: How long…how much of a leeway do we have before we really need to get started on that?

H: …You know, we started out discussing there is a risk of these things happening at any time. You know, perhaps as technology increases, there is an increasing risk. So the sooner we're prepared to deal with the event, the better, and the more risks there are, the longer the time goes that we're not prepared.

Q: But see, the two are not mutually exclusive. I really don't think that the people that are preparing first responders are necessarily people doing this high level research.

H: No, they're not.

L: Well, it's a competition for resources, and I think we're going to be needing to bring some resources to basic research or longer range research.

Q: You know, given the fact that we expect asymmetric warfare to really be …the way that nations attack us. I mean, given the fact that we have a tremendous conventional and nuclear arsenal, if you declared war on us, you're rather crazy. Shouldn't we be diverting some of our current conventional military spending?… Maybe the real issue is that at the high policy level, people need to be diverting some of the spending.

H: Well, actually, it might be a surprise to a lot of people, but I think a lot of the conventional military spending was going into the types of areas you're describing. The government for a long time had an intensive research program, both with respect to chemical weapons and biological weapons — and a lot of it has been for defensive research along the lines of detection and means for protection. It's probably not a thing that has gotten a lot of attention in the news media and people aren't very aware of it, but they're probably the primary researchers in this area.

Q: Another thing that Dr. Alibek recommended, and I know nothing about this, but this was an interesting concept to me. He said, "Find a way to destroy the bacterial toxin when it is released using proteolytic enzymes." What are proteolytic enzymes?

H: Well, those are enzymes that will break down in proteins, and they break down the protein components of toxins so they would be a means to, if you could hit, for example, an airborne toxin and you could disperse particles of enzyme or particles containing enzyme in the air, then they could perhaps, since enzymes are very specific in what they attack, they would attack the proteins in the toxins and render it a non-toxin, non-poisonous. And that could be perhaps a good means of defense. And again, like some of these other ideas you mentioned earlier, that sounds like a very promising avenue or approach to research, and if you could get that creatively into some specific ideas that actually could be shown to work in the real world, that would be very effective.

L: An advantage of that is that enzymes work over and over; they will chew up one molecule after another. By contrast, it is also possible to develop antibodies in your blood that you could give to protect against a number of things, including chemical agents. But that's a one to one — you have to have a molecule of antibiotic for every molecule of strep that you're attacking, and it gets very difficult to give enough of that to a person to neutralize all that'd you have to deal with. With large molecules it doesn't work well.

Q: So the proteolytic enzymes, are they given to someone in a shot or are they released into the atmosphere? How would they would be done? How would they be…?

H: Well, usually proteolytic enzymes would be things you would find, for example, in the human body or in animal bodies, like it's part of the digestive process. They would break down the proteins that you eat into smaller particles and then break those down… So if you take these same types of enzyme substances, or biochemical tablets, and you could specifically make them in a way that you could disperse in that area, for example, with your protein toxins, they would break those down in the same way it breaks down proteins in the food you eat. And it would be a very effective defense.

L: You could also administer it by injection, or even by inhalation…

H: Yeah, I mean, all those things. There are specific technological approaches you've got to work out, but all those are possibilities.

Q: What about the…how serious is the problem for bacterial disease outbreak, it's a fact that we're seeing an increase in antibiotic resistant bacteria? Does that mean that we're going to have trouble responding to a bacterial attack? Is it likely, for example, that drug resistant anthrax is going to show up, things like that? And what can we do about this problem? I know a lot of it is propagated by feeding antibiotics to livestock, etc., and yet we continue to do that. How serious a problem is this?

L: A nation state with the laboratories and researchers available to it can't either find or compare an antibiotic resistant strain with multiple bacteria entities. Viruses are the only thing. So having viral strains that are resistant really won't make a whole lot of difference.

If there are an increased number of wild strains of some of the good biological agents, and I would think of these for a domestic terrorist — don't forget, we have domestic enemies as well as foreign — to get their hands on is a starting approach. The regulations have clamped down on the ability to order cultures from the American Type Collection, for example, other places where you used to be able to get bacteria pretty much on request. So now a would-be terrorist would have to go out and find a way to harvest it either at a hospital laboratory, where the cases don't show up often, or find it in the wild or in other parts of the world where the diseases are endemic. And that makes it tougher. I don't think that antibiotic resistance in the wild is going to particularly contribute to our problems in dealing with weapons of mass destruction. In terms of that addition to livestock feed…we're going to be treated with antibiotic if you get a prescription for these kinds of medicines. This is the major source of antibiotics in the world. Of course, there it comes back to the things they were trying to teach us in medical school …don't prescribe it unless you really have a good reason for [an antibiotic]strategy. It imposes a duty on the patient to take the thing as it's prescribed. If you take a few days of it and feel better and stop taking it, the chances getting a drug resistant strain of a bacteria in your body are much greater than if you take it four times a day for ten days, if that's how it was prescribed. So, yes, there is a real problem, but not so much in the weapons of mass destruction sphere.

Q: One of the few recognized diseases that we actually have outbreaks of — and it's not a lot; we get 10 to 15 cases a year — is the plague, and that is primarily in the southwestern United States. Are we learning from that? Are those…are they recognizing it pretty quickly when it happens down there? So basically could we say that we were reasonably covered for the plague since we should presumably have knowledgeable doctors in the southwest, or is it always a surprise and takes a few deaths for us to recognize it? I really don't know how they've handled…

L: They're usually sporadic cases and they're generally pretty well ended. It is not just the southwest. The CDC's plague inventory is in Ft. Collins, Colorado…We look for other things in places where it's known to be [endemic], the local health departments can track it from rodents, cull them for fleas and then test the fleas for the presence of plague. They look for die-offs in prairie dog towns. Ranchers look for that, too. They don't like prairie dogs, and they've been known to pick up dead prairie dogs from one colony that has acquired the plague and haul it a few sections over and throw it another prairie dog and hope they'll get the plague. There was an outbreak a couple of years ago in the city of _____, Colorado, and the community responded quite well to it. They built a defense. We do get surprised occasionally. There was a death several years ago… a person who had been exposed to a cat in Colorado and went home to Arizona or New Mexico, wherever it was, and became ill and died before we realized what it was. But police in that part of the country, doctors are aware of… Now, if there were a plague outbreak in Central Park, I don't know.

H: I think one of the answers here to the question is that in the eastern part of the United States, the suspicion would not be as high. It would be much less likely that doctors would recognize what they were dealing with.

Q: And so that's an area where the western and southwestern states have a lot to contribute and they could be documenting these few cases that come along, because plague has been recognized. I think you know how many countries [have weaponized plague] — it's like 4 or 5, an insignificant number, Russia is one.

H: Yes, Dr. Alibek tells us about the Soviets' weapons, [and also] countries like China and North Korea…

Q: If I were to create a biological weapon, and I certainly have access to Internet and I have a bathtub, I have cooking utensils — I don't have a laboratory. What do I need? I mean, how hard is it going to be, how long is it going to take me to get up to speed in warfare?

H: Well, like you're suggesting, you need good information, and then Internet probably is not always the best source. Some of the information is good and some of it's not. It's not a refereed journal, so a lot of the information that's on it is just wrong. And actually, that's been very fortunate, because a lot of the people who have tried terrorist incidents have used that as an information source and it's misled them. And particularly in the area of how to disseminate a chemical or biological weapon, it's been particularly misleading. So in a way, the online information source has become sort of this natural defense system for us by giving wrong information out there. But then other things you would need, as Dr. Leffingwell was talking about, you would need an original source of the microbes that you were going grow up and you'd need equipment and medium to grow them up, so you'd need to know how to make cultures and perhaps fermentation equipment like they would use in the pharmaceutical industry.

Q: You know, that's how it's been described. It's been compared to running your own microbrewery. But the difference with a microbrewery is that the worst that's going to happen to you is you sample too much of your product and might get drunk. You know, even when…when labs have the reverse flow hoods and the glove boxes, etc., there's still the occasional infection, so, you know, yes, it might be as easy as brewing beer, but isn't the likelihood that I would self-infect really high?

H: Well, yes, that too. But also most of the incidents where people get infected in laboratory settings like that are where they actually have breaches of usual laboratory safety practices. A good example of that is the U.S. government's anthrax production plants around the time of World War II. There were a number of serious incidents where people got severely ill and died, but all of those were related to violations of laboratory practices. They would do something like they'd lift up the front of the hood because something got stuck in the pipette so they'd lift it up and stick their head in and then try to loosen it and get aerosolized anthrax in their face. Or they would turn the valves the wrong way and release large quantities of liquid anthrax culture. But these were all things that were out of the ordinary. I think almost all those could have been avoided if they had rigorously stayed with laboratory safety practices.

L: There are significant risks if you can get the starting culture to go. It can be done rather easily and not very expensively, and with care a terrorist would have a reasonable chance of getting a culture cultivated to the point that they had a large number of organisms without killing themselves. It's when they get to the dissemination stage that things get really interesting, and many difficulties. You know, even if you don't hurt yourself, it's difficult to do that right.

Q: Well, while it might be difficult to track.. species coming into the country, while we don't really have testing for that, to set up a biosafety level 3 or 4 lab requires pretty specialized equipment. To have an automatic sprayer you can attach to a weapons device, you know, or a munitions warhead, those are not real easy, at least in this country. Should we be tracing the sale of things like that?

H: This could be done, just as the drug enforcement administration did with tracking the components that are needed to make certain illegal drugs, we could track these types of things. You could track the ingredients that are needed to make chemical weapons, and that could be the means of making a very useful surveillance system.

L: It's worth doing. It makes it harder for the terrorist and that may be enough to do the trick. They may have to do something else to vent their frustrations instead of that particular type of attack.

Q: I think that's actually all the questions I had. Is there anything you'd want to add? This has been a terrific interview and we got a lot of good stuff from this. Is there anything else you'd like to add that hasn't been covered?

L: You talked a lot about biological weapons, and I would like to caution that chemical weapons are still very much a useful threat. Not so much trained chemists doing up their up their own homemade nerve agents, but people are going to deliberately release dangerous industrial chemicals and I think we need to be prepared to deal with that as well.

H: And think about the recent incidents of nation states using chemical weapons. You know, the threat of Libya making chemical weapons by converting a pesticide. Iraq really is the only nation state in history that's used sarin in war, and they also used mustard in war — one of the only ones to recently do that. So these things are very real threats that are out there, the potential for release is high. And like biological weapons, they're not that hard to make. They're made from relatively simple reagents, they're relatively inexpensive, the technology is not all that difficult. So, you know, these are things we may be seeing more and more of.

Q: So do you think that chemical attack would probably be more likely than biological? It's a little bit less scary — you can see a chemical. You can't really see your own biological weapons and you've no idea what you've got in there, how many spores are releasing, etc., unless you're really a high level biochemist. So do you think that's more common, simply given the fact that, like you say, fertilizer is one, pesticides. There are standard chemicals — chlorine — standard chemicals that are used to combine into a chemical weapon. And I don't think we could trace it. I don't think we could effectively or efficiently trace those, or could we?

L: We could. It would be possible if you start with the very basic ingredients. I think probably a DCR filter and a _____ might be able to generate phosphorous and you'd generate some chlorine then to react with the phosphorous by using the same kind of filter — table salt. And so on. You could eventually build up to the nerve agent and it would be difficult, the chances of having something go wrong or being detectable along the way are considerable. If you tried to start with something more sophisticated-- a few thousand pounds of phosphorous trichloride, I think it's…they have controls on that. They'll find you. Quickly. Try to order _____ , that will trigger not just a national but an international warning, they'll get you. This still could be done.

Q: What about pesticides, though? So many people have a right and a reason to be using pesticides.

L: The prime focus is different, and it's hard to take a pesticide apart and put it back together in different combinations to where it's a good nerve agent. You'd probably be better off trying to start from scratch. There's still quite a number of very dangerous chemicals easily accessed. Unfortunately, a lot of them are very close to populated areas. Anhydrous ammonia is still used as a refrigerant, commercial refrigeration in some downtown

locations. If you open a good sized tank of that you could pretty well decimate city blocks. Other things are available in large quantities.

Q: One of the conventions, either biological or chemical and you'll probably know which one — I think it's biological — is considered a very weak convention because there's no inspection provisions, and part of it was our choice. We did not want to give away a competitive edge, and certainly one of the heavy uses that cyberspying is being put to now, and also by some governments, is to spy on various industries on behalf of their national industry, their industries, to get the competitive edge. And that in some countries is considered legitimate and acceptable. So I can understand why our own pharmaceutical and bioengineering companies would say, "No, we don't want to deal with them for inspection." So how do we get past that? How do we get past the fact that we can't turn around and say, "Well, you're Iraq, we're inspecting you," if we're not going to let people inspect us? Or should we let them? We do risk losing a lot because everybody knows [our research is at a} high level and how much money we have to throw at biotechnology; it's a growing industry.

L: Tough question. I don't think we have experienced the kind of threat that would make us want to go to that intrusive a solution yet. If at some point we do experience such a threat, I think we would find some terrorists could carry out a successful attack that might have been avoided by measures of this fashion similar to that in the Chemical Weapons Convention. And the federal government worried about The Chemical Manufacturers Association when we were considering the Chemical Weapons Convention. [They] initially feared they would not be able to sell a treaty with the inspection provisions needed to be successful. They consulted with the Chemical Manufacturers Association and were pleasantly surprised to get a hearty affirmative. You have the seeds now to go back. And I think if there were a clear leak, we could probably find a way to work around some of these concerns of the lab community.

H: I think you're right in that one of the big issues is the lack of perceptual clarity. There's never been, really, an attack like this that has been a substantial threat, that's caused substantial disruption and casualties. In the absence of that, there isn't any refined perception of clarity, and kind of that's a corollary to the type of issue that you're dealing with, with physicians not really putting awareness of chemical and biological weapons high on their list of priorities for continuing education. They don't see it, so it's not as immediate a threat problem.

Q: Yes, and one of the issues, of course, is that, you know, not only is it not something we see as a clear need—the need to have our biotechnology industry inspected because we're not really that worried yet about a biological weapon and don't foresee that's it an immediate threat… But there's also a competing clear need which we have addressed through a recent economic espionage act…industrial spying, typically using advanced networking technology. So actually there's a competing theory — we have a need to protect our industries that can contribute to our economic well being.

H: That's true.

Q: So there's kind of a no-win situation going on right there.

H: It's also very difficult when you have inspections like that because we have somewhat of an experience with it, it's very hard for inspectors to sort out what's not an industrial use and what might be illicit use for just chemical and biological weapons. It's very hard to look at an organophosphate pesticide plant and say that normal legitimate activities really don't

include production of nerve agents. It's very hard to look at fermenters in a pharmaceutical plant and say, "These aren't being used for illicit purposes."

Q: I think it was Jim Woolsey who pointed out that if you can, you know, create a biochemical weapon as easily as you can make beer, that we're really going to have to rely… I don't think he put it like this, but essentially neighbor kind of watching neighbor. You know, we're going to have to be aware that someone in a rural community in an abandoned farmhouse is not actually producing beer, why do they need a microbrewery setup? That kind of goes against the American way. We tend to let people go their own way…Should we be encouraging sort of neighborhood watch programs, or is that too much paranoia for us right now? Too dangerous to our civil liberty loving society right now?

L: It's not going to work very well because the hits would be few and far between. If there were more terrorists out there, then we probably want to do that. But right now, I think we would encourage prying for no good reason. And of course, you know, when you talk about a microbrewery, it could be sort of a big vat, _____ table, high as the room, but a thirty gallon water heater could be converted. I have a 750-gallon fermentation tank buried in my back yard — it's called a septic tank. It would take some effort to convert it to the production of biological weapons, but it can be done.

Q: So that's really not viable. Do you think we have any fears of… I mean, are we mostly fearing foreign terrorists using this? There have been — and you mentioned the culture lab that people used to be able to get cultures from. I think there was a religious right group who wanted the…you know, the posse comitatus types, that did try to obtain — was it Ricin they tried to obtain? And they actually kind of embraced the concept of ricin as part of their group strategy. So are we worried about domestic terrorists producing these types of things?

H: I think we are, yes. Most of the incidents that federal agencies have dealt with to date have been domestic groups. So I think that that's very much on the list of risks that we concerned with.

L: Ricin is produced from castor beans which can be domestically cultivated.

H: In fact, every country in the world cultivates them. That's an extremely common crop, so very easily grown.

Q: And I think that instructions --I don't know if it's in the Turner Diaries, but it was one of those spread out through the Internet to some of the far right terrorist groups--how to cultivate castor beans.