The Looming Threat

Bioweapons are much more prevalent and virulent than most of us realize. And we have little defense.

Mark Williams Pontin

In 1918, a strain of influenza killed between 20 million and 40 million people around the world—more people in one year than had died of the Black Plague in four. In the United States, nearly a third of the population was infected; so many died that streetcars were used as hearses in some cities.

The Spanish flu of 1918 was the last fast-burning pandemic in the developed world. Increasingly sophisticated treatments and health policies have made infectious diseases of diminishing concern in the West. Heedlessly, we act as if the eradication of infectious disease is inevitable.

In the 21st century, new pathogens will nevertheless emerge, as humans encroach on the biosphere and germs evolve into antibiotic-resistant forms. The most frightening possibilities, though, lie with genetically engineered biological weapons.

"You can speculate about a plague-Ebola combination," Serguei Popov, a Russian molecular biologist, told me last summer when I visited his offices at George Mason University in Fairfax, Virginia. "I know that those who ran the Soviet bioweapons program studied that possibility. I can talk with certainty about a synthesis of plague and Venezuelan equine encephalitis, because the guy who did that presented the data to me."

Before fleeing Russia in 1992, Dr. Popov had probably done as much with genetically engineered pathogens as anyone.[1] In the '80s, he made his name by devising a new class of bioweapon: genetic hybrids using pathogens and human DNA that

1 Leitenberg, M. (April 16, 2002) Biological Weapons and Bioterrorism in the First Years of the 21st Century, paper delivered to a conference in Rome entitled "The Possible Use of Biological Weapons by Terrorist Groups: Scientific, Legal and International Implications": 57,72–4.


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would goad victims' immune systems into attacking their own nervous systems, inducing brain damage, paralysis, and death, leaving behind only the myelin produced by the victims' own bodies.[2]

2 Serguei Popov, interview (Nov. 13, 2000) *Journal of Homeland Defense*, www.homelandsecurity.org/journal/articles.asp.

"With the myelin toxin, the infection might initially show symptoms like those of typical plague or mild pneumonia," Dr. Popov explained. The hybrid genes that he and his team engineered would themselves be spliced into some more innocuous bacterium like *Legionella pneumophila*, the bacterium responsible for Legionnaire's disease. Thus, Dr. Popov continued, victims would first show pneumonia's typical symptoms. "So the person would be treated for those and feel healthy. Then the disease's second wave would come two weeks later, and it would be devastating."

By hiding deadly genes within the genome of some milder bacterium, Dr. Popov genetically engineered creations that reflected a general strategy developed by the Soviet bioweapons program. This achieved its most perverse refinement in the "binary inoculary." With these maleficent scenarios, treatment of the initial symptoms produced by the first microbe would trigger a second microbe's lethal growth.

"If the scenario was plague plus Venezuelan equine encephalitis, for instance, the first symptom would be plague itself, and the victim's fever would be treated with something as simple as tetracycline," said Dr. Popov. "But that tetracycline would itself be the factor inducing expression of a second set of genes, which could be a whole virus or a combination of viral genes."

Were there, I asked, any limits for such recombinant pathogens? "Essentially, the combinations are unlimited," Dr. Popov explained matter-of-factly. If the combination is plague-Ebola, treatment with tetracycline could trigger an Ebola gene that remained dormant until that point. A recombinant agent could first be introduced into a target population using an aerosol. Then victims would enter other major population centers, fall ill, and become walking Ebola bombs. "It's ugly," he added. "But the person who suggested this in 1987 got promoted."

A pandemic of such perfect deadliness could never occur in nature, where the filoviruses, Ebola and its cousin Marburg, are such effective killing machines that their very lethality works against them. Their hosts die before the virus can perpetuate another cycle. The recombinant scenario described by Dr. Popov sidesteps Ebola's self-defeating aspect, though. Carriers of such a delayed-onset pathogen could scatter across a whole continent. The potential exists for a fast-burning pandemic that conceivably could dwarf any other known epidemic.

That is what bioterrorism could do.

Are we prepared for biological attack?

Awakened rudely by the terrorist attacks of September 11TH, 2001, Americans suffered further jitters the following month. Anthrax-laced mail closed down the Hart Senate Office Building and the Brentwood postal center in Washington, D.C. Spore-laden letters also arrived at media organizations and private homes in New York, Connecticut, and Florida. When October's anthrax scare was over, five Americans had been killed by bioterrorism. Embarrassingly, it seemed the bioterrorist had almost certainly been an insider in the U.S. bioweapons program: the anthrax bacilli were identified by Paul Keim, a specialist at Northern Arizona University, as an ultravirulent strain developed at the U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID) in Fort Detrick, Maryland.

Unresolved questions will occupy conspiracy theorists for decades. If a U.S. bioweapons expert hoped to make Washington pour billions into biodefense, he or she achieved that goal. First, Congress passed the Biopreparedness Act of 2002. Then, in January 2003, President George W. Bush's State of the Union address presented Project Bioshield, calling for a fivefold increase of the $1.3 billion allocated for anti-bioterrorism. In May, Representative Billy Tauzin (R: Louisiana) brought a draft of the Project Bioshield Act of 2003 before the House Committee on Energy and Commerce. The full House approved its version of the bill in June.

Project Bioshield would "spur the research and development of new vaccines, drugs, or other countermeasures," Representative Tauzin promised, against threats like "anthrax, botulinum toxin, the plague, Ebola, and similar viruses." Government funding would open the floodgates of innovation at pharmaceutical companies. And the bill would create "increased flexibility in various areas—from procurement and peer review to personnel matters" and during emergencies empower the Secretary of Health and Human Services to dispense experimental drugs—whatever these might be—"on a large-scale basis to millions of Americans."

People joining the new U.S. Department of Homeland Security (DHS) were skeptical. During their confirmation hearings in July, officials suggested that $6 billion from Project Bioshield might not go very far in persuading the biopharmaceutical industry to sink capital into researching new vaccines. The vagaries of politics might mean that the promise of government investment one term might disappear altogether the next.

Some senators asked about the 19 naturally occurring bioterror agents that the Defense Science Board listed. What about other, possibly unlisted, bioterror agents or new, genetically engineered pathogens? Members were reminded that vaccines (of sorts) existed to treat many of the 19 listed bioterror agents, including anthrax and smallpox. "Nevertheless, the list of 19 pathogens does not include new species that might be engineered," a high-ranking official, slated to oversee DHS's counterterrorism R&D, conceded in closed hearings, adding that he looked forward to working with Congress to further address the "important issue" of creating incentives for the biotechnology industry to research anti-bioterror vaccines.

It was another day of double-talk in Washington. Many politicians likely knew that conservative estimates put the number of potential bioterror agents at 70 to 80, not merely 19. For genetically engineered pathogens, the possibilities were wide open. From the '70s on, the Russian bioweapons program, Biopreparat, had developed agents resistant to drugs or vaccines, reportedly creating some 2,000 strains of drug- or detection-resistant smallpox alone.[3] But Biopreparat's efforts were antiquated compared to modern genetics' ability to create multiple novel engineered pathogens.

3 *The Economist* (January 30, 2003) Who will build our biodefences? 366

A month earlier, in June, the House Select Committee of Homeland Security heard from Paul Redmond, the department's assistant secretary for information analysis, whose office was charged with the job of ranking potential bioterror agents in order to recommend what vaccine research to fund. Since Mr. Redmond spent a quarter-century in the Central Intelligence Agency and had been the CIA director's chief counterespionage adviser, he is presumably an experienced Washington player. But he arrived that day with no opening statement and explained that he was absolutely unprepared to brief any lawmakers in a closed session. His knowledge of bioterrorism was no greater than their own, and he was not getting information

about bioterrorism threats from the intelligence community. Mr. Redmond's performance was that rare, fascinating event: a Beltway insider so frustrated by the inherent contradictions of his job that he honestly admitted his complete inadequacy.

Moans of distress resounded from both sides of the aisle after Mr. Redmond explained just how little his office had achieved since he had reported for duty at DHS March 17TH. Representative Christopher Shays (R: Connecticut) expressed "shock, depression, outrage, embarrassment, and concern." Of Mr. Redmond's testimony, Shays said: "They're basically acknowledging that they're useless." Representative Jim Turner of Texas, the panel's ranking Democrat, was surprisingly charitable toward an office that was the Bush administration's bureaucratic progeny. "It was clear that the Office of Information Analysis is not functioning the way it was envisioned," Representative Turner told *Government Executive* magazine.[4]

4 Gorman, S. (June 9, 2003) Lawmaker decries disconnect between intelligence, security. *Government Executive*.

Washington policy makers and media closed ranks to cover Mr. Redmond's blowout. Members of Congress suggested that Mr. Redmond's testimony proved just how much congressional hearings mattered. *Government Executive* opined that Project Bioshield would need to change its name to Project BioMop if the DHS didn't start getting good intelligence so as to allocate its $6 billion for vaccines. All of which, of course, assumed that good intelligence about bioterror threats existed and that Project Bioshield's premises made sense.

Are vaccines a viable strategy?

Had government officials reviewed the intelligence obtained years before from a former Soviet scientist, they would have realized how false those assumptions were. Kanatjan Alibekov changed his name to Ken Alibek when he defected from Russia to America in 1992 and guaranteed himself a place in Cold War history. Dr. Alibek's debriefing—alongside that of biologist Vladimir Pasechnik, who in 1989 brought to the West the first accounts of Soviet research on genetically engineered pathogens—presented the U.S. defense community with bad news of epic proportions. Even longtime biowarfare hawks like Bill Patrick—hailed by some and vilified by others as the father of America's bioweapons program—were shocked by what Dr. Alibek revealed.

Called out of retirement for the defector's debriefing, Dr. Patrick would later recall burying his head in his hands as he listened to Dr. Alibek's account of the Soviet program. Dr. Alibek explained that by the late '50s, biowarfare research facilities dotted the Soviet Union. In 1972, the United States, the Soviet Union, and more than 100 other nations signed the Biological and Toxin Weapons Convention, prohibiting deadly biological agents except for defensive research. After 1972, Soviet bioweapons had become a secret state industry, and Soviet leader Leonid Brezhnev launched his country's most ambitious arms programs since it developed the hydrogen bomb.

As Dr. Alibek explained it, many Soviet bureaucracies contained a department that was a part of the clandestine "archipelago" of Mr. Brezhnev's bioweapons program. Army factories in major city centers manufactured mind-boggling tonnages of smallpox and anthrax. Existing state laboratories and research centers were drawn into biowarfare research. An entire "research city" for genetic engineering arose south of Moscow. Altogether, Dr. Alibek told the Americans, the Soviet Union's secret bioweapons industry was being maintained by 60,000 employees by the '80s. Biopreparat alone employed 30,000 scientists and engineers. Dr. Alibek

himself had spent 17 years as a Soviet bioweaponeer and had become Biopreparat's deputy chief—essentially, its head scientist and manager.

Bioweapons work physically marks anybody who enters the profession, in a fashion that strikes to the heart of the question of vaccines. On a sunny afternoon late this summer, I sat with Dr. Alibek in an office at George Mason University. With us was Charles Bailey, whose résumé includes 25 years of research into infectious diseases and biodefense with the U.S. Army and command of USAMRIID at Fort Detrick. Dr. Alibek's autobiographical book, *Biohazard*, outlines some job perils:

> *I have lost all sense of smell and have the broadest range of allergies of anyone I know. I can't eat butter, cheese, eggs, mayonnaise, sausages, chocolate, or candy. I swallow two or three pills of anti-allergy medicine a day—more on bad days, when my sinuses start to drain. Every morning, I rub ointments over my face, neck, and hands to give my skin the natural lubricants it has lost. The countless vaccinations I received against anthrax, plague, and tularemia weakened my resistance to disease and probably shortened my life.*[5]

5 Alibek, K., S. Handelman (1999) *Biohazard*. Random House: 51.

When I read out a part of this, Dr. Alibek looked away and muttered in Russian. But Dr. Bailey said, "When I worked at USAMRIID, we had accurate records of every vaccine I ever received. When my vaccine record was unfolded, it was probably 15 feet long."

"Charlie and I are not so old," Dr. Alibek finally said. "But it's true that we've lost our sense of smell and also—I notice this with many who've done our kind of work—our hearing comes and goes." Hearing is inevitably affected by respiratory system infections, Dr. Alibek continued, and vaccines are nothing but disabled pathogens producing antibodies within a human subject's system. "Antibodies produce immune complexes whose long-term effect on organs has never been studied. I cannot even imagine vaccinating a large population against a range of biological agents. Excepting vaccines for smallpox and polio, it's not going to work."

"It's highly improbable that you would hit people with 19 different vaccines," Dr. Bailey agreed. "Besides, if the only threat is bioterrorism, that's not a natural threat. So, as far as having people receive vaccines against such a possibility—people in Kansas, in Oklahoma, in rural Texas—they'd say 'go to hell.'"

Both men, then, dismiss the notion of "hardening the population" against biological attacks with a range of preëmptive vaccinations. Nevertheless, large-scale vaccinations are precisely what Project Bioshield proposes. But Dr. Alibek and Dr. Bailey have other suggestions.

"The first thing I'd do is deëmphasize the use of vaccines," Dr. Bailey said. "Part of what the United States has done, I agree with. We do need drug stockpiles, training to respond to threats, and consequence management to contain outbreaks. But I'd concentrate on understanding host-pathogen relationships so we could design specific therapeutics. I'd spend a large portion of the budget on that."

Dr. Alibek added, "Vaccines were a great revolution in medicine, but we must ask what else we can do. Given a wide spectrum of possible agents, our job is to develop pre- and post-exposure prophylactics." Unfortunately, vaccines have been effective against so many infectious diseases that medical understanding of those diseases' specific causes and pathogenesis, their differences and similarities, and how the human immune system reacts remains surprisingly undeveloped.

Anthrax is a case in point. "The literature on how anthrax kills was 50 years old and, we've discovered, false," Dr. Bailey explained. "Early inhalation anthrax is treatable with antibiotics. However, at a certain point, it starts affecting different organs, so antibiotics don't work and even increase the hazard. Effectively, anthrax becomes another disease, needing different treatment. Moreover, as it keeps progressing, anthrax then becomes yet another disease, requiring yet another approach. A cascade of things kills people—not simply lethal toxins generated by the pathogen infecting the macrophages, as everybody thought. We've published this, but some laboratories took their time accepting it."

The point of such research, Dr. Bailey and Dr. Alibek both insisted, was that it opened new avenues for countermeasures against pathogens. Particularly, both men believed in the possibilities for boosting innate human immune system response. "When you talk about a specific threat—like anthrax or smallpox—we generally know what immune system mechanisms provide such protection as we have," said Dr. Alibek. "Theoretically, it's possible to boost immune system response and have extra protection for weeks or months. In fact, we have done this work already."

But only in mice. Finding human test subjects for agents like anthrax presents difficulties. "For human testing, this work might be more applicable as a defense against the common cold," Dr. Bailey speculated. Despite the fact that boosting the innate human immune system response was the goal of many research teams, none have been especially successful—certainly not to the extent necessary to provide protection against biological weapons. Many leading medical researchers would say that they did not even think such a goal was achievable. But Dr. Alibek and Dr. Bailey claim that boosting human immune response *could* become a defense against both natural and designer pathogens. Their approach, if it's remotely viable, offers more hope than the rudimentary assumptions about vaccines promoted by Project Bioshield's supporters in Washington.

Still, if Dr. Alibek and Dr. Bailey are right, the task is immense. The advances of the genomics revolution and bioinformatics are sufficient only to let us glimpse that the work involved—fully mapping and understanding the complex interactions of hosts and pathogens for all the biological threats we know can be weaponized—would take decades, maybe longer.

Consider the lethal agents that we currently know about.

The known threats

Plague, tularemia, glanders, typhus, smallpox, anthrax, Q fever, Venezuelan equine encephalitis, brucellosis, botulinum toxin, dengue fever, Lassa fever, Russian spring-summer encephalitis, Marburg, Ebola, Bolivian hemorrhagic fever (or Machupo), Argentinean hemorrhagic fever, and 50 or more other biological agents are currently considered possible weapons. This is a far larger tally than the 19 serious threats recognized by the U.S. Defense Science Board. And the likelihood should not be discounted that other naturally occurring pathogens, emerging now from recently breached ecosystems in tropical rain forests, will soon provide suitable material for a weapons lab.

"Strategically, we need to understand that there is a big threat to mankind coming from microbes generally," Dr. Alibek told me. "In the last 30 years, a critical mass of 2,000 or 3,000 new pathogens has appeared. Some are from nature. Some may be pathogens designed in laboratories, though not necessarily as biological weapons."

Sophisticated technological processes are not needed to manufacture the deadliest biological weapons. A Soviet effort that used Ebola and Marburg is instructive. With either of these hemorrhagic fevers, billions of viral particles proliferate within the host, rupturing host cells. As each cell bursts, the virus shoots out filament-like threads to hook into surrounding cells and infect them, a process that eventually breaches capillaries throughout the host's body and—as the filoviruses prevent normal coagulation—causes blood to pool and seep through the host's skin till great patches of body surface become wet with it. In 1988, this happened to a Russian bioweapons scientist named Nikolai Ustinov, who accidentally injected himself with highly concentrated Marburg. A virus grown in lab conditions is often more virulent after passing through the live incubator of a human or animal body: Ustinov's colleagues discovered after his autopsy that the Marburg from their comrade's remains was even more potent than the original strain. Hence, they commemorated the dead man—who had been well liked—by naming this new strain Variant U and harvesting it as a weapon.

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KEN ALIBEK

Using guinea pigs to concentrate the virus, Marburg U was converted into an aerosol. The virus was then tested on 12 monkeys in a large indoor chamber and, pleased with the results, the Soviet Ministry of Defense approved it as a weapon in early 1990.[6] By 1991, Ebola had joined the armamentarium. Both filoviruses are bizarrely horrific killing machines. Ebola is classified as an international Level 4 Pathogen (higher than AIDS, which is a Level 2) with a very short incubation period of 2 to 21 days and a mortality rate of 70% to 90%. Its rate of mutation cloaks it from any vaccine that could be developed and is a millionfold greater than its retroviral relatives like HIV. Even without a lethal chain of transmission of continental reach, the filovirus's deadliness could conceivably kill thousands if aerosolized over a U.S. city.

6 Miller, J., S. Engleberger, W. Broad (2001) *Germs: Biological Weapons and America's Secret War.* Touchstone: 255.

Still, according to Dr. Alibek and Dr. Bailey, if bioweapon designers want pandemics that burn through large segments of a population, we need not look further than a couple of old acquaintances. "If the influenza strain the world saw in 1918 appeared today, it would be even more devastating," said Dr. Bailey. "Yes, we have better medical facilities. Yes, we have better plans for isolating victims. But did we have air travel back then? Did we have mass transit? Did we have today's population densities? Those factors make it even more difficult to stop that type of virus. I think the mass-transit capability all over the world—not just within the United States—will overwhelm any defensive mechanism we establish. I really believe that." If stabilized in an aerosol, says Dr. Alibek, influenza is capable of creating a pandemic.

Smallpox remains a threat, too, and raw material for the bioweapons lab. "If smallpox is delivered as an aerosol in high concentrations, that changes the incubation period," says Dr. Bailey. "The textbooks say smallpox's incubation period is between 10 and 12 days. We believe that if, in reality, smallpox was aerosolized and released, that period would be shortened to three to six days. As far as genetic engineering, if we're talking today's technology—rather than what terrorists will be able to do 20 years from now—a state like North Korea could incorporate other viruses into the

smallpox genome. If the genome for Venezuelan equine encephalitis was introduced into smallpox, for example, you'd get a two-day incubation period. You'd get your immune system reduced by the Venezuelan equine encephalitis. Then you'd be hit by lethal smallpox afterward. That scenario is even scarier than naturally occurring smallpox, which has a 30% to 40% fatality rate."

Such a possibility is pure conjecture. But such thought experiments allow us to grasp the potential of genetically engineered threats.

The coming threats

Hunter, Bonfire, and Flute. For people trying to understand what the Soviet bioweapons experts achieved, the names of these three projects loom through the fog of secrecy that cloaked the Soviet bioweapons industry. Serguei Popov participated directly or indirectly in some of this research—and what is most surreal, he worked on a project in which endorphin-expressing genes were inserted into viral genomes in the hope of creating agents that would cause fatal overloads of bliss.

Hunter's role is fairly clear: it systematically combined different viruses' genomes to engineer novel pathogens with exotic killing properties. Flute focused on psychotropic and neurotropic agents. By the late '70s, years ahead of Western researchers, Russian bioweapons experts had already replicated in their laboratories the human regulatory peptides that, when activated during times of stress or great emotion, trigger profound changes in our nervous systems.[7]

7 Ibid.: 230–1.

Then there's Bonfire. According to certain defectors' accounts, Bonfire created antibiotic-resistant agents. By other reports, Bonfire developed recombinant pathogens, as Hunter did. According to yet other accounts, Bonfire, like Flute, dealt with manipulations of peptides and hormones that affect the nervous system.

Even Dr. Alibek never knew exactly what went on at Bonfire, although he was Biopreparat's scientific manager. It was a top secret industry. Soviet scientists routinely had "legends" to cover their work's true nature; in turn, they might be deceived by those with higher security clearance. Certain projects—like Bonfire—became their own secret fiefdoms.

Matters have not necessarily been clarified, despite the Soviet Union's demise. Despite Russia's official denials, covert bioweapons programs have continued. The status and whereabouts of Russian scientists and their research is often in doubt. Pathogens are not a quantifiable substance like fissionable material; they grow and die, and no one knows what became of all the biological materials that Russian bioweaponeers created. Russia maintains only haphazard control over whatever remains of its bioweapons program: security is lax to nonexistent at more than 50 sites in the former Soviet Union. Finally, Russian biologists who participated in the Soviet programs and subsequently defected have not been forthright. Some have been willing to say anything to interest Western debriefers. Others have explained as little as possible about their former careers.

Dr. Popov was initially in this last category. After defecting, he moved to Dallas to do research in immunology and pharmacology at the University of Texas Southwestern Medical Center—but he didn't reveal his career history. In 1999, Dr. Popov contacted Dr. Alibek, president of Advanced Biosystems, and was debriefed. Now a senior scientist with Advanced Biosystems, Dr. Popov spends time at George Mason University, where Dr. Alibek and Dr. Bailey have established the National Center for Biodefense. When I interviewed Dr. Popov, I asked him if he had worked on Bonfire.

"I ran my own program, called Factor, which overlapped with Bonfire," Dr. Popov said. Factor's purpose had been to use peptide virulence factors to create pathogens, he explained. Clues had existed about possible approaches: Soviets already had ideas about how to use peptides to induce effects like temporary schizophrenia, sleeplessness, and memory loss. Laying out scenarios for delivery of such an agent in freeze-dried, aerosolized form, Dr. Popov studied the varying difficulties entailed in one or another pathogen culture and formulation. Soon enough, he moved on to scenarios involving such "binary inoculary" pairings as plague plus Venezuelan equine encephalitis or, finally, plague plus Ebola. The Russians were experts at originating such ideas.

"Especially Biopreparat leaders," Dr. Popov said. "One in particular—Igor Ashmarin." Dr. Ashmarin had been both a Soviet army general and a molecular biologist. "He was like a demigod. You talked very politely and quietly, and couldn't contradict him. And Dr. Ashmarin seemed quite good at molecular biology," Dr. Popov recalls. "He and some associates finally published two papers on the effects of these peptides expressed by vaccine strains of different kinds. Rats injected with these vaccine strains have totally changed behavior."

Run for cover

John Arquilla, a RAND analyst and a professor at the Naval Postgraduate School, is one of the nimblest thinkers on 21ST century defense issues and an important influence on the current civilian leadership at the Pentagon (see "Terror and Its Antidote," page 60). If anyone had a plan (plausible or otherwise) for countering bioterrorism, it would be him. But when I interviewed him at the school in Monterey, California, this summer, he was gloomy. "What every American should understand is that we cannot have perfect, leak-proof defenses," Dr. Arquilla said. "The enemy may always get one hit in. But a scenario where 250-plus million people get infected is quite far-fetched. Very simply, if somebody can do something like that, it's game, set, and match for them."

Dr. Arquilla thinks it would be difficult to neutralize the rogue bioweaponeers and mitigate such a biological attack. "We could own every Russian bioweapons expert for the rest of their lives for about the price of one F-18 attack aircraft," Dr. Arquilla says. "You have these scientists—who are unhappy, underpaid, underloved, you name it—possessing this tremendously advanced biological science in a country in economic decay. So we need an actual program and we need to spend. These Russians could be the people who will, first, help us prevent the spread of biological weaponry and, second, think about better defenses against the threats which undoubtedly are coming."

But it is unlikely that the tens of thousands of scattered Biopreparat experts can be corralled with American dollars, and besides, the Russians haven't cornered the bioweapons market. Most experts believe the anthrax mailings of 2001 came from malcontents employed at U.S. laboratories. In 1984, 751 restaurant patrons in Wasco County, Oregon, came down with food poisoning after ingesting *Salmonella* bacteria that was planted by members of the religious Rajneeshee cult. Members of another cult, the Japanese doomsday group Aum Shinrikyo, developed anthrax spores and experimented with aerosolized botulinum toxin. The raw and simple power of biological threat agents gives Osama bin Laden's spokesman, Sulaiman Abu Ghaith, the confidence to brag that al Qaeda has "the right to kill 4 million Americans" in

response to casualties he claims have been inflicted on Muslims. Plenty of people have access to the bad goods.

The naïveté of the biological research community is also to blame. The level beauty of Western biomedical science is that it is, for the most part, distributed freely among those who use it. This transfer of knowledge among scientists is also quite leaky, and leads to the unsettling realization that scientists, in their freewheeling way, make unwitting accomplices to a global bioterror. In an address to the National Research Council in Washington, D.C., during January 2003, George Poste spoke about scientific openness and national security. (Dr. Poste is an adviser to *Acumen)*. A former head of SmithKline Beecham and currently the chairman of a Defense Department task force on bioterrorism, Dr. Poste recalled a recent biotech conference. He had attended a presentation on agents that augment memory: "A series of aged rats were paraded with augmented memory functions, some very elegant structural chemistry was placed onto the board....Then with the most casual wave of the hand the presenter said, 'Of course, modification of the methyl group at C-7 completely eliminates memory. Next slide, please.'" Dr. Poste further concluded that Western biotech efforts perpetuate the phenomenon of "dual use," by which beneficent technological advances can find malignant application with Third World actors. Dr. Poste summarized the situation of one well-known technology: "What we now have is the momentum in the gene therapy community to develop stealth viral vectors, which completely escape detection by the immune system."

From a biosecurity perspective, we have a long way to go, and it is not clear if the U.S. government is up to the task. Multilateral reduction or elimination of bioweapons arsenals is no mean feat, and we need look only as far as the nuclear arms example to see how sovereign nations can, if they wish, create havoc with international policy. Even trying to get a handle on the biological threat agents on our own shores has proven difficult. Homeland Security's so-called 42 CFR Part 73—"Possession, Use, and Transfer of Select Agents and Toxins," administered by both the U.S. Department of Health and Human Services and the U.S. Department of Agriculture, has resulted in a welter of rules and interpretations so mystifying and confusing that one researcher was arrested simply because he traversed a room where a select agent was stored.

It wouldn't take much to breach even the tightest security measures and compromise a nation's health infrastructure. Dr. Poste and others warn about an epidemic of the "worried well," in which a few hundred cases of, say, smallpox, would require the rapid vaccination of millions of people in a short time, easily overwhelming our public health system. So while experts talk about coördinated global systems of biosecurity, the reality is that our own security systems are not prepared.

There is a growing sense amongst bioterror experts that the public is simply unaware of the true threats of bioterrorism. Project Bioshield, as currently formulated, is a placebo with which Washington policy makers hope to quiet the public. Its premises are weak and unsubstantial. The U.S. population *cannot* be "hardened" against biological attack. Emerging technologies, such as biosensor devices, are largely experimental. Vaccines will *not* be forthcoming from big pharmaceutical companies. A good defense against bioweapons has not yet been proposed. Most of all, bioterrorism is *not* science fiction—rather, biotechnology is more powerful than any technology that has preceded it in human history and it is just as Janus-faced. 1