Toxic Archipelago: Preventing Proliferation from the Former Soviet Chemical and Biological Weapons Complexes

Amy E. Smithson

Report No. 32

December 1999

11 Dupont Circle, NW
Ninth Floor
Washington, DC
20036
phone 202.223.5956
fax 202.238.9604
info@stimson.org

The Henry L. Stimson Center
11 Dupont Circle, NW
Ninth Floor
Washington, DC 20036
tel 202.223.5956 *fax*
202.238.9604
email info@stimson.org

Preface and Acknowledgments

This report is the second major narrative by the Stimson Center's Chemical and Biological Weapons Nonproliferation Project on the problems associated with the vast chemical and biological weapons capabilities created by the USSR. An earlier report, *Chemical Weapons Disarmament in Russia: Problems and Prospects* (October 1995), contained the first public discussion of security shortcomings at Russia's chemical weapons facilities and the most detailed account publicly available of the top secret chemical weapons development program of Soviet origin, code-named *novichok*.

Toxic Archipelago examines another aspect of the USSR's weapons of mass destruction legacy, the proliferation problems that stem from the former Soviet chemical and biological weapons complexes. Given the number of institutes and individuals with expertise in chemical and biological weaponry that have been virtually without the financial support of their domestic governments since the beginning of 1992, this report provides an overview of a significant and complex proliferation dilemma and appraises the efforts being made to address it. This topic and other issues of chemical and biological weapons proliferation concern are also covered on the project's worldwide web page, which can be found at the Chemical and Biological Weapons Nonproliferation Project section of the Stimson web site at: www.stimson.org/.

The Chemical and Biological Weapons Nonproliferation Project was inaugurated in January 1993 with a grant from the Carnegie Corporation of New York. That month, the international community gathered in Paris to sign the Chemical Weapons Convention, a treaty banning poison gas that entered into force on 29 April 1997. The project serves as a watchdog over the implementation of this accord and its sister treaty, the Biological and Toxin Weapons Convention. The project also functions as an information clearinghouse on all issues related to chemical and biological weapons proliferation and nonproliferation. The project's final role is that of problem solver, seeking to draw attention to proliferation problems and to improve the policies, treaties, and other mechanisms that aim to reduce the threat presented by chemical and biological weapons.

Numerous individuals contributed to the author's research for this report. She wishes to thank the personnel of the International Science and Technology Center for their cooperation with her research. Numerous ISTC staffers shared their own insights and experiences. The ISTC also helped by arranging interviews with biological weapons experts

who have received ISTC grants. With the ISTC's assistance, the author was able to obtain a better perspective of what is happening on the "front lines" of grants to the former Soviet weaponeers. Some organizations might not have been so cooperative with an independent investigation of this nature. A chemical weapons institute also allowed the author to spend the day on its premises, interviewing scientists there who are part of ISTC-sponsored research projects. She would thank individuals by name, but those involved in the Moscow phase of this research effort asked for anonymity.

The author is grateful that representatives of the Civilian Research and Development Foundation also made time available for interviews, as did several current and former U.S. government officials who are linked in one capacity or another to nonproliferation programming targets the scientists of the former Soviet weapons institutes. The author honors the requests of these individuals not to be named, but she wishes to thank them for their candor and willingness to participate in this research effort.

Several individuals at the Stimson Center also contributed to this report's preparation. Along the way, Michael Krepon, the Stimson Center's president, provided substantive guidance and encouragement. For the final draft, he pitched in with his always-helpful reviewer's eye. Throughout the effort, the author depended heavily upon Leslie-Anne Levy, research associate, and Mei-i Zien, research assistant. These two women went above and beyond the call of duty performing research tasks and compiling information for the report. The input of Levy and Zien significantly influenced the report's tone and substance. They also put the report in its final attractive form for both the print and worldwide web editions. Levy and Zien did all of this with a positive disposition that made the preparation of this report a pleasant experience.

In addition, the author wishes to acknowledge the role played by Jonathan Tucker of Center for Nonproliferation Studies at the Monterey Institute in the initiation of this report. In December 1998, Tucker asked her to prepare a brief analytical paper on the International Science and Technology Center as part of Monterey's overall assessment of the Cooperative Threat Reduction Program. As she undertook this research, the author concluded that the topic was deserving of much more in-depth exposition. Aside from helping to spur the research, the Monterey Institute helped to defray some of the costs associated with the author's research trip to Moscow.

This research was undertaken principally with grant funds from the Carnegie Corporation, the Compton Foundation, and Margaret Spanel. In particular, the author wishes to thank David C. Speedie III, Patricia Nicholas Moore, and Deana Arsenian of the Carnegie Corporation and Edith T. Eddy of the Compton Foundation for their continued support of her work. Other activities of the Chemical and Biological Weapons Nonproliferation Project benefit from the grant assistance of the John D. and Catherine T. MacArthur Foundation and the Ploughshares Fund.

Amy E. Smithson, Ph.D.
Senior Associate

Table of Contents

List of Tables, Figures, and Charts

List of Abbreviations

CRDF	Civilian Research and Development Foundation
GosNIIOKhT	State Institute of Organic Chemical Technology
INTAS	International Association for the Promotion of Cooperation with Scientists from the Independent States of the Former Soviet Union
IPP	Initiatives for Proliferation Prevention
ISTC	International Science and Technology Center
STCU	Science and Technology Center in Ukraine

Toxic Archipelago: Preventing Proliferation from the Former Soviet Chemical and Biological Weapons Complexes

Amy E. Smithson

INTRODUCTION

They were among the most privileged members of their society, with advanced educational degrees, access to the best health care and stores, guaranteed subsidized housing, and often six weeks or more of paid vacation at exclusive resorts. Compared to their countrymen, their salaries were astronomical.[1] As they graduated in the top ranks of their medical or scientific schools, they were approached by recruiters who spoke of jobs in high-level science, sweetening the offer with the lure of additional graduate education at the nation's premier universities. Many of this select group embarked on their careers with little or no idea that they were entering the toxic archipelago, the USSR's ultra secret network of germ warfare and poison gas research and development institutes.[2]

In 1992, with the Soviet Union consigned to the history books, the dispensations of these scientists quickly began to evaporate. Virtually overnight, tens of thousands of biological and chemical weaponeers found themselves without a concrete source of income,

[1] ISTC staff member, interview with the author, Moscow, 15 September 1999; ISTC staff member, interview with the author, Moscow, 16 September 1999. Those who worked at the weapons institutes received about 25 percent more in salary than the average Soviet. Scientists conducting dangerous pathogens had wages that were roughly double what their fellow citizens were paid. Biological institute director, interview with the author, Moscow, 17 September 1999.

[2] Two former bioweaponeers said they reported to their first day of work with no clue they would be working with dangerous pathogens, one being totally shocked upon seeing the hermetically sealed doors of a high-level biosafety laboratory. Head of laboratory, interview with the author, Moscow, 17 September 1999; ISTC staff member, 16 September 1999 interview with the author. In a 17 September 1999 interview with the author, the director of a biological institute recalled that it was about two years before he realized that his research was part of a weapons development effort. Even more time passed before authorities read him briefly into the real nature of his work, after which the KGB forbid him to travel abroad to scientific conferences. Another individual noted that word eventually leaked out about the involvement of certain institutes, such as Russian State Research Center of Virology and Biotechnology in Koltsovo and the Institute of Pharmaceutical Biotechnology in Stepnogorsk, in weapons research and production. Refusing to work as such institutes, and even leaving them, was possible during the Soviet era, although the careers of those who did so undoubtedly suffered. ISTC staff member, 15 September 1999 interview with the author.

stripped of their elite status.[3] These scientists were the living legacy of prodigious research programs that significantly expanded the horizons of biological and chemical warfare. Before long, aspiring proliferators began to troll through the biological and chemical institutes—islands of toxic know-how and deadly warfare agents scattered across twelve newly independent countries—intent on persuading increasingly destitute scientists to divulge their weapons expertise and even put weapons materials up for sale. The former Soviet chemical and biological complexes, shown in Figure 1, constituted an ideal proliferation spawning ground.

This deeply disturbing situation was not the only proliferation problem that arose when the USSR split at the seams. The proliferation problem of principal concern was the possibility that some of the 27,600 former Soviet nuclear weapons might fall into the wrong hands. An ominous term—loose nukes—was coined to portray these circumstances.[4] To avert a nuclear catastrophe resulting from the uncertain control of the mighty Soviet nuclear stockpile, Senators Richard Lugar (R–Indiana) and Sam Nunn (D–Georgia, ret.) teamed to rush U.S. assistance to help secure and dismantle this arsenal.[5] This effort, known as the Cooperative Threat Reduction program, has become a centerpiece of U.S. strategy and programming for coping with post-Cold War national security threats.

---

[3] According to an individual who witnessed the hardship that began to sweep through the chemical and biological institutes in 1992, the outside world has little appreciation for "how much these scientists have suffered, how people can be corrupt, or how difficult daily life is." ISTC staff member, interview with the author, Moscow, 17 September 1999.

[4] The total number of Soviet nuclear warheads in 1991 was 35,000. Robert S. Norris and Thomas B. Cochran, *U.S.–USSR/Russian Strategic Offensive Nuclear Forces, 1945–1996* (Washington, D.C.: National Resources Defense Council, January 1997), 43. Four countries inherited portions of the Soviet nuclear arsenal: Belarus, Kazakhstan, Russia, and Ukraine. Instantaneously, Ukraine found itself to be the third largest nuclear power in the world. Outside experts worried that the command and control of these weapons were not reliable, that the physical security around them was relatively weak, and that many weapons did not have permissive action link devices that would thwart unauthorized use. See, for example, Oleg Bukharin and William Potter, "Potatoes Were Guarded Better," *Bulletin of the Atomic Scientists* 51, no. 3 (May/June 1995): 46-50. Kazakhstan handed over its 1,410 strategic nuclear warheads to Russia in 1995; Ukraine, its 1,825 warheads in May 1996; and Belarus, its eighty-one strategic nuclear warheads in November 1996. Rodney W. Jones, Mark G. McDonough, Toby F. Dalton, and Gregory D. Koblentz, *Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998*, Carnegie Endowment for International Peace (Washington, DC: The Brookings Institution Press, 1998), 29.

[5] On 25 November 1991, the Senate voted eighty-six to six to approve $500 million in assistance to enable the safe storage and transport of Soviet nuclear weapons and to begin their dismantlement. For the original legislation and debate, *Congressional Record* (Washington, D.C.: 25 November 1991): S18001–S180014. See also, Don Oberdorfer and Helen Dewar, "Senate Votes to Assist Soviet Nuclear Cutbacks," *Washington Post*, 26 November 1991, A17; Public Law102–228, 12 December 1991.

Not long after loose nukes became common parlance, another phrase entered the post-Cold War security lexicon. "Brain drain" is linguistic short hand for the possibility that governments or terrorists attempting to acquire nuclear, biological, chemical, or missile capabilities might siphon off the human expertise behind the USSR's weapons of mass destruction. From the bottom to the top of the U.S. government, brain drain garnered an appreciable amount of attention throughout the 1990s. In the words of President Bill Clinton:

> The average salary of a highly-trained weapons scientist in Russia. . .is less than $100 a month. Now, for a small investment, we can help them turn that expertise to peaceful projects that help the world and draw a living wage doing it. Or we can do nothing, and pray that each and every one of those thousands of scientists will somehow resist the temptation to market their expertise to those who wish to do us and the cause of freedom harm. Common sense says to me that we ought to give them something useful and good to do and let them make a decent living.[6]

The prospect of wayward nuclear scientists was a major motivation for starting a group of grant assistance programs, namely the International Science and Technology Center (ISTC), the Civilian Research and Development Foundation (CRDF), the Science and Technology Center in Ukraine (STCU), and the Initiatives for Proliferation Prevention (IPP) program.

In the early 1990s, real nuclear weapons expertise was concentrated in just a handful of countries, underscoring the grave consequences of nuclear brain drain.[7] In comparison, prevailing wisdom held that the expertise for concocting biological or chemical weapons was much more widespread. After all, individuals with medical, microbiology, and chemistry degrees can be found in virtually every country. Therefore, the bias at the outset of brain drain prevention programming was in favor of funneling research grants to former

---

[6] White House, "Remarks by the President at the 100th Meeting of the Veterans of Foreign Wars and the 86th Meeting of the Ladies Auxiliary" (Washington, D.C.: Office of the Press Secretary, 16 August 1999).

[7] The five long-recognized nuclear powers are China, France, Russia, the United Kingdom, and the United States. In 1998, the nuclear club expanded by two as India and Pakistan conducted underground tests to prove their nuclear capabilities. John F. Burns, "Pakistan Answering India, Carries Out Nuclear Tests," *New York Times*, 29 May 1999, A8.

Soviet nuclear weapons scientists to keep them gainfully and peacefully employed.[8] As the 1990s came to a close, however, U.S. leaders also gradually began to speak out about the proliferation threat resident in the former Soviet chemical and biological weapons institutes. "Given the size of the Soviet biological and chemical programs and the fact that we know a lot of other nations are trying to develop chemical capacity and some biological capacity," when it came to brain drain Clinton declared that "we had not only nuclear problems, but we have a chemical and biological problem."[9] The president was not the only principal U.S. policy maker to look beyond the infamous closed nuclear cities. As Senator Lugar noted:

> In our visits and conversations we have learned of the desperate conditions which exist in the nuclear cities and biological institutes across Russia. These weapons scientists and engineers are not getting paid. In some cases their government has abandoned them. We must remain vigilant. These are not the random foot soldiers about which we have heard countless tales of derangement and desperation. The men and women of the nuclear, chemical and biological institutes don't carry automatic weapons in their hands, they possess the knowledge and the ability to develop weapons that could kill millions.[10]

According to one adage, recognition of a problem is half of the solution to it. That aphorism certainly does not apply when it comes to the proliferation threats latent in the biological and chemical weapons institutes.

The festering concerns of U.S. leaders have not yet translated into meaningful resources to address the chemical and biological weapons brain drain threat. A comparison of resources devoted to nuclear, missile, chemical, and biological brain drain programming reveals a major disparity in favor of nuclear and missile scientists. This report concludes that the grant assistance reaching the chemical and biological weapons scientists is glaringly

---

[8] Former U.S. government official, interview with the author, Washington, D.C., 13 April 1999; senior ISTC staff member, interview with the author, Moscow, 16 September 1999. When the United Nations Special Commission sent inspectors into Iraq to dismantle Iraq's weapons of mass destruction programs, the nuclear and missile programs also received priority over Iraq's chemical and biological programs. U.S. biodefense expert, interview with the author, Washington, D.C., 21 May 1999.

[9] Quote from President Clinton excerpted from "Interview of the President by the New York Times," White House (Washington, D.C.: Office of the Press Secretary, 23 January 1999).

[10] Statement of Richard Lugar, Press Conference on His Trip to Russia (Washington, D.C.: Office of Senator Richard Lugar, 24 November 1998).

insufficient given the scope and implications of the proliferation threat that the toxic archipelago presents.

This report was compiled from public sources as well as extensive first-hand research in the form of interviews with current and former U.S. government officials and with numerous veterans of the former Soviet chemical and biological complexes. The ISTC graciously cooperated with this research effort, as did many others. With three exceptions, the individuals who granted interviews and otherwise helped with this research asked for anonymity. Therefore, the bulk of those interviewed are characterized by their positions instead of being identified by name.

To set the proper context for an examination of brain drain prevention programming, the next section of the report describes in quite some detail the nature of the proliferation problems associated with the former Soviet biological and chemical weapons institutes. The third chapter presents an overview of the main organizations that provide grant assistance to these germ warfare and poison gas scientists, followed by a chapter evaluating the early track record of the ISTC, IPP, STCU, and CRDF with regard to the chemical and biological weapons institutes. This chapter also covers the main critiques of brain drain prevention programming, namely the possibility that grant funds might be diverted to weapons work and that grant recipients might be moonlighting for proliferators. The fifth chapter explores the adjustments that have been made to these grant programs. This segment of the report also describes grants funded by the United States to engage former Soviet bioweaponeers in cooperative research on dangerous pathogens and to tighten the security at a small group of biological institutes. The report wraps up with a chapter of observations and recommendations.

A TICKING PROLIFERATION TIME-BOMB

A few months after the Soviet Union collapsed, Russian President Boris Yeltsin stepped forward to concede that the USSR had systematically violated the Biological and Toxin Weapons Convention. This admission was a startling reversal from stiff-lipped Soviet denials of a long-suspected clandestine biological weapons program, and Yeltsin gave rise to further optimism by ordering a halt to such activities.[11] In September 1992, Moscow declared that the offensive biological weapons program had been terminated, stating that production lines had been dismantled and program funding and personnel costs had been reduced by 30 and 50 percent, respectively.[12] Yeltsin offered to allow U.S. and British inspectors into the facilities concerned, a deal that came to be known as the trilateral agreement.[13] The intent of these on-site visits was to dispel concerns that Russia still harbored an active biological weapons program.

After Russian teams visited eight U.S. facilities and U.S.–British delegations took trips to ten Russian facilities, the trilateral inspection process foundered in an atmosphere of hostility.[14] Russia has yet to allow access to four key military biological institutes: the

---

[11] Decree of the Russian Federation on Fulfilling International Obligations with Regard to Biological Weapons, Moscow, 11 April 1992 R. Jeffrey Smith, "Yeltsin Blames '70 Anthrax on Germ Warfare Efforts," *Washington Post*, 16 June 1992, A1; J. Dahlburg, "Russia Admits It Violated Pact on Biological Warfare," *Los Angeles Times*, 15 September 1992, A1. Even earlier that year, Yeltsin hinted a few times that such an announcement would be forthcoming. See Milton Leitenberg, "The Conversion of Biological Warfare Research and Development Facilities to Peaceful Uses," in ed. Erhard Geissler and John P. Woodall, *Control of Dual-Threat Agents: The Vaccines for Peace Programme*, Stockholm International Peace Research Institute Chemical and Biological Warfare Studies 15 (London: Oxford University Press, 1994): 77–8.

[12] Richard Boucher, U.S. Department of State, "Joint US/UK/Russian Statement of Biological Weapons," Press Release, Office of Public Affairs (Washington, D.C.: 14 September 1992).

[13] This arrangement was necessitated not only by British and U.S. concerns that offensive work may have still been underway within the Russian biological weapons complex, but by the fact that the biological weapons ban lacked any verification measures whatsoever. The trilateral agreement was announced in mid-September 1992. See ibid.

[14] Contrary to Russia, which continued offensive work into the 1990s, the United Kingdom and the United States aborted their biological weapons programs in the late 1950s and 1960s, respectively. Therefore, argued one U.S. bureaucrat, inspections should have occurred only in Russia. U.S. government official, interview with the author, Washington, D.C., 6 January 1998. Inspections of the U.S. commercial sites took place in February 1994, at which time Russian authorities equated such factors as idle fermenter capacity to a biological weapons capability. U.S. government official, interview with the author, Washington, D.C., 30 December 1997; U.S. government official, interview with the author, Washington, D.C., 31 December 1997; U.S. government official, interview with the author, Washington, D.C., 2 January 1998; U.S. industry official, interview with the author, Washington, D.C., 2 January 1998; U.S. government official, interview with the author, Washington, D.C., 6 January 1998. See also, briefly, "Biological Weapons Convention: Chronology 1994," *Arms Control Reporter* 10, no. 3 (14 February 1994): 701.B.123–4.

Center of Military-Technical Problems of Biological Defense at Yekaterinburg; the Center for Virology at Sergiev Posad; the Scientific Research Institute of Military Medicine at St. Petersburg; and the Scientific Research Institute at Kirov. No trilateral inspections of Russian sites have taken place since 1994. More recently, however, there have been indications that some type of confidence-building activities might resume.[15]

Although Russia ratified the Chemical Weapons Convention in the fall of 1997,[16] the Yeltsin government has shrugged off charges that the USSR also allegedly operated a covert chemical weapons development program.[17] According to a 26-year veteran of the Soviet chemical weapons complex, Dr. Vil Mirzayanov, the USSR developed, tested, and produced tens of tons of a few novel chemical nerve agents that are five to ten times more lethal than any other known chemical agents. This new generation of poison gas, known by the codename *novichok*, was built from agrochemicals so that offensive weapons production could more readily be hidden within a legitimate commercial industry.[18] Given these circumstances, concerns about ongoing activities in possible violation of the chemical and biological weapons bans overshadow Russia's chemical and biological complexes.

---

[15] On 17 December 1998, U.S. and Russian military officials agreed in principle to reciprocal visits to military biodefense facilities. Jonathan B. Tucker, "Bioweapons in Russia: Stemming the Flow," *Issues in Science and Technology* 15, no. 3 (Spring 1999): 38.

[16] By a vote of 288 to 75, the State Duma approved the accord on 31 October 1998, and Russia subsequently deposited its instrument of ratification on 5 November 1997. See David Hoffman, "Lower House of Russian Parliament Ratifies Global Chemical Weapons Ban," *Washington Post*, 1 November 1997, A22.

[17] In 1987 and 1988, at the very time that the *novichok* program began to crest, Col. Gen. V. Pikalov stated that the USSR did not possess and was not working on binary chemical agents. After Dr. Vil Mirzayanov's allegations became public, U.S. officials objected that the Soviets did not declare the *novichok* agents under the terms of a bilateral agreement. Gen. Anatolii Kuntsevich, who later would head Yeltsin's presidential committee to dismantle the chemical and biological weapons complexes, stated that such agents were not in the stockpile and that Russia had "played the game under the agreed-upon-rules." D.L. Averre, "The Mirzayanov Affair: Russia's 'Military-Chemical Complex," *European Security* 4, no. 2 (Summer 1995), 274, 279.

[18] For Mirzayanov's personal account of this program, see "Dismantling the Soviet/Russian Chemical Weapons Complex: An Insider's View," in *Chemical Weapons Disarmament in Russia: Problems and Prospects*, report no. 17 (Washington, D.C.: Henry L. Stimson Center, October 1995): 21–33. Mirzayanov made his charges publicly in the Russian press in a 10 October 1991 article entitled "Inversion" in the newspaper *Kuranty* and again in a co-authored article in *Moscow News* dated 16 September 1992, the same day that the story broke in the Western press. See Will Englund, "Ex-Soviet Scientists Says Gorbachev's Regime Created New Nerve Gas in '91," *Baltimore Sun*, 16 September 1992, A3.

The scale of the Soviet biological weapon program leaves even seasoned weapons experts stunned. In addition to four military facilities employing 15,000, the USSR constructed a web of about fifty nominally commercial facilities, known collectively as Biopreparat, that engaged in germ warfare research, development, testing, and production. The former Deputy Director of Biopreparat, Dr. Ken Alibek, revealed in great detail how this weapons program operated.[19] Other branches of the program were hidden in the KGB, the Ministries of Agriculture, of Health, of Public Culture, and the Soviet Academy of Sciences. The Soviets employed roughly 65,000 in the vast biological warfare complex, including about 40,000 in Biopreparat, of whom 9,000 were key scientists and engineers.[20] Soviet scientists researched the military application of some fifty agents, successfully weaponizing plague, anthrax, smallpox, tularemia, brucellosis, and Marburg, among others. They genetically altered strains of these diseases to make them more resistant to antibiotics and began to experiment with disease combinations called chimeras. The Soviets produced thousands of tons of anthrax, smallpox, and plague for delivery aboard a variety of systems, including ballistic missiles.[21] In addition to agents deadly to humans, the Soviets put 10,000 to work on plant and animal pathogens. Three top centers of anti-crop and anti-animal agents were the Scientific Agricultural Research Institute in Kazakhstan, the All-Russian Institute of Animal Health in Vladimir, Russia, and the Pokrov Institute of Veterinary Virology.[22]

The former Soviet chemical weapons complex was quite formidable as well. Declared at 40,000 metric tons and stored at seven sites, Russia possesses the world's largest

---

[19] Alibek's book, *Biohazard*, served as a principal resource for the information presented in this paragraph. See Ken Alibek, with Stephen Handelman, *Biohazard* (New York: Random House, 1999).

[20] In comparison, the former Soviet nuclear community is estimated at 50,000 to 60,000. U.S. government official, interview with the author, Washington, D.C., 19 May 1999.

[21] Briefly, see Tucker, "Bioweapons in Russia," 34–5. For other descriptions of the USSR's germ warfare program, see Anthony Rimmington, "From Military to Industrial Complex? The Conversion of Biological Weapons' Facilities in the Russian Federation, *Contemporary Security Policy* 17, no. 1 (April 1996): 80–112; Leitenberg, "The Conversion of Biological Warfare Research and Development Facilities," 77–105.

[22] The first of this trio of institutes amassed two hundred anti-animal strains and focused on cow and sheep pox and blue tongue, while the second specialized in foot-and-mouth disease and the third in African swine and horse fevers. Judith Miller, "Long Island Lab May Do Studies of Bioterrorism," *New York Times*, 22 September 1999, A1.

chemical arsenal.[23] The USSR produced nerve agents at the Khimprom plants at Novocheboksarsk and Volgograd, while blister agents were made at Dzerzinsk. Controversy arose when the Russian government announced that out of economic necessity it had dismantled some of this production capacity without international inspectors present.[24] These sprawling chemical facilities are struggling to keep their work forces gainfully employed with commercial endeavors, but success at solo marketing of commercial products and launching joint ventures with Western chemical companies has been limited.[25] The agents produced in these facilities were created in the State Institute of Organic Chemical Technology (GosNIIOKhT), which employed approximately 6,000 in four main branches that conducted the research, development, and testing of chemical agents.[26] In addition, the chemical weapons complex included testing facilities at Shikhany and Nukus, Uzbekistan, and several bureaus in the Moscow area that worked on the technical delivery designs for the munitions.[27]

---

[23] For a description of this arsenal and the plans being made to destroy it, see Maj.Gen. Roland Lajoie, "Cooperative Threat Reduction Support to the Destruction of Russia's Chemical Weapons Stockpile," in *Chemical Weapons Disarmament in Russia*, 35-47. The detailed history of the Soviet chemical program can be found in Joachim Krause and Charles K. Mallory, *Chemical Weapons in Soviet Military Doctrine: Military and Historical Experience, 1915–1991* (Boulder, Colo.: Westview Press, 1992).

[24] This problem is discussed in Jonathan B. Tucker, "Viewpoint: Converting Former Soviet Chemical Plants," *Nonproliferation Review* 4, no. 1 (Fall 1996): 78–89. Russia changed its position in 1999 and decided to request permission to convert all of its former production sites and allow inspection of them. "Chemical Treaty Being Implemented Unevenly," *The CBW Chronicle* 2, issue no. 6 (Washington, D.C.: The Henry L. Stimson Center, August 1999), 8. See also, Judith Miller, "Russia Discloses Details of Its Former Chemical Arms Program," *New York Times*, 30 November 1999, A8.

[25] One noteworthy exception was a joint venture announced in September 1997 between E.I DuPont de Nemours and AO Khimprom at Novocheboksarsk to package and produce herbicides. John J. Fialka and Carla Anne Robbins, "DuPont Plans Russian Venture At Weapons Site," *Wall Street Journal*, 12 September 1997, A4.

[26] Between 500 and 600 scientists worked in the Moscow branch of GosNIIOKhT, which had a total of 3,500 employees. The Volgograd branch, which specialized in research on soman and new binary agents, employed between 500 and 700. Shikhany, which worked on the synthesis and testing of new agents, employed about 600 scientists. Approximately 1,500 worked there, including technicians in the production of agents. Another research branch of GosNIIOKhT with about 300 employees was located within the large chemical weapons production facility at Novocheboksarsk. Dr. Vil Mirzayanov, interview with the author, Washington, D.C., 28 April 1999.

[27] These weapons design bureaus did not report to the Ministry of Chemistry, but may have reported to the Ministry of Defense. Three of the more powerful design bureaus were Pishti, the Basalt Scientific Production Corporation, and the Novokujbeshiv Design Bureau. Ibid.

The legacy of the Soviet chemical and biological weapons programs simultaneously presents several problems to those trying to confront it. First, the dissolution of the Soviet empire left intact the facilities, capabilities, and personnel that comprised the biological and chemical complexes, automatically saddling the nascent Belarussian, Georgian, Kazakh, Ukrainian, and Uzbek governments with weapons capabilities that they knew little about and were ill prepared to dismantle, convert, or absorb into commercial sector. To complicate this scenario, not much was known outside of the former USSR about these facilities, which increased the difficulty of targeting collaborative research aid to these sites. Progress is being made at a few facilities outside of Russian territory. For instance, agreements have been reached to dismantle the Nukus chemical test site at Nukus, Uzbekistan, and the biological production facility at Stepnogorsk, Kazakhstan.[28] The general pattern of Cooperative Threat Reduction and brain drain prevention efforts has been to focus first on the sites and scientists in Russia, giving lower priority to the newly independent states of the former USSR.[29]

Second, many assumed that Yeltsin's decrees would bring definitive shape to the direction and accountable implementation of chemical and biological weapons policies. After ordering the cessation of offensive biological weapons activities, Yeltsin issued decrees about the destruction of chemical weapons and the creation of a Presidential Committee on Problems of Chemical and Biological Weapons Conventions. This committee was charged with overseeing the destruction of the chemical arsenal and bringing the activities within the chemical and biological complexes into compliance with the relevant treaties.[30] With Yeltsin's influence waning in Russia's fledgling democracy, presidential

---

[28] On 25 May 1999, the U.S. government signed an agreement with $32.2 million in economic aid to help the Uzbeks safely dismantle and clean up the Nukus facility. See Judith Miller, "U.S. and Uzbeks Agree on Chemical Plant Cleanup," *New York Times*, 25 May 1999, A3. Initial domestic and bilateral efforts to convert the Scientific Experimental and Production Base at Stepnogorsk did not fare well, so on 5 December 1996, the Kazakh and U.S. governments signed a deal to dismantle the main and auxiliary biological weapons equipment at this facility. For more detail, see Gulbarshyn Bozheyeva, Yerlann Kunakbayev, and Dastan Yeleukenov, *Former Soviet Biological Weapons Facilities in Kazakhstan: Past, Present, and Future*, Occasional Paper no. 1 (Monterey, Calif.: Center for Nonproliferation Studies, Monterey Institute of International Studies, June 1999): 14–6.

[29] Of the 202 ISTC grants made in 1996, 192 went to Russian scientists, three apiece went to Armenia and Georgia, and two apiece to Belarus and Kazakhstan. Richard J. Seltzer, "Moscow Science Center Lauded," *Chemical & Engineering News* (23 December 1996): 29–30.

[30] One 1996 Yeltsin decree that has been "enthusiastically ignored" requires that 4 percent of the federal budget be invested in civilian science. "Science in Russia: The Diamonds in the Rubble," *The Economist* (8 November 1997): 25. The presidential committee was established by presidential decree no.

decrees have lacked authority. The Duma, apparently, can pass secret laws bearing on national security affairs that could contradict Yeltsin's decrees.[31] Of necessity, Yeltsin has delegated responsibility for implementing his orders, leaving open the possibilities that his representatives have not closely followed the progress of conversion efforts or may have been deceiving him about the status of these complexes.[32]

Several of the presidential committee's senior officials have lengthy careers in the poison gas and germ warfare programs.[33] Arguably, it is difficult, if not impossible, to expect all of the individuals who built these military capabilities to embrace their dismantlement and conversion into peaceful, commercial enterprises. Outside of the presidential committee, numerous managerial positions in the chemical and biological institutes and their supervising ministerial departments are still filled with many of the very same individuals who set policies for these facilities during the Soviet era. Gen. Yuri Kalinin, for instance, took the helm of Biopreparat in 1979 and remains ensconced there. Observes Mirzayanov with concern, "Victor Petrunin, the director of GosNIIOKhT who was given the Lenin prize for the successful development of the *novichok* agents, is still in a position of authority."[34] According to Alibek, "There is still a thin layer of officials who

---

532 on 25 May 1992. See Igor Khripunov, "Russia' Legal Basis for Chemical Demilitarization," *Chemical Weapons Destruction in Russia: Political, Legal and Technical Aspects*, ed. John Hart and Cynthia D. Miller, Stockholm International Peace Research Institute Chemical and Biological Warfare Studies 17 (London: Oxford University Press, 1998), 37–9. More information on chemical weapons destruction program decrees can be found in "Special Federal Programme: Destruction of Chemical Weapons Stockpiles in the Russian Federation," PC–XIV/B/WP.7 (The Hague: Preparatory Commission for the Organization for the Prohibition of Chemical Weapons, 25 June 1996).

[31] For instance, the Duma reportedly approved a decision to transfer of the World Health Organization smallpox strains from the Ivanovsky Institute to the State Research Center for Virology and Biotechnology, known as Vector, at Koltsovo, and to justify research with smallpox at Vector. Another development that might be attributed to a secret Duma law is the restoration of Compound 19 at Yekaterinburg. Dr. Ken Alibek, interview with the author, Washington, D.C., 5 June 1999.

[32] Ibid. For a related discussion of whether Soviet political leaders knew of the offensive chemical program or were themselves engaged in deceptively abetting it, see Averre, "The Mirzayanov Affair," 280–2.

[33] For example, Kuntsevich, the former deputy chief of the Chemical Forces, originally chaired this committee. For a list of other holdovers, see Rimmington, "From Military to Industrial Complex?" 90.

[34] Dr. Vil Mirzayanov, 28 April 1999 interview with the author. Other cases of this holdover phenomenon include senior chemist M.I. Kabachnik and Maj.Gens. I.L. Knunyants and A.V. Fokin of the Nesmeyanov Institute of Organoelement Compounds in Moscow, I.V. Martynov of GosNIIOKhT, and N.N. Yukhtin of Moscow's Scientific Research Institute for Plant Protection Against Agents. Petrunin claimed that "disarmament can't be accomplished without [GosNIIOKhT]." Averre, "The Mirzayanov Affair," 284–5. Of particular concern to Mirzayanov is the fact that the successor to the KGB, the Russian Federal Counterintelligence Service (FCS), still controls much of what happens at GosNIIOKhT facilities.

still want to conduct offensive work or at the very least want to be prepared for a possible restoration of full offensive activities if someone else comes to power who favors such a policy."[35] To wit, Lt.Gen. Valentin Ivanovich Evstigneev, senior official in the Ministry of Defense's 15th Directorate overseeing the biological complex, reportedly lamented that having his scientists involved in commercial projects would be a "quiet tragedy."[36] Such circumstances breed doubt as to whether all offensive work has indeed ceased.

In addition, the biological and chemical weapons communities ripple with stories of corruption and how the senior managers of Biopreparat and GosNIIOKhT began amassing personal fortunes when government assets were privatized. After the Soviet government crumbled, banks sprang up across Russia, many reaping profits from money loaned at exorbitant rates. Biopreparat and GosNIIOKhT both branched into the banking business. Lending truth to the concerns about corruption, some senior managers in the chemical and biological complexes exhibit signs of wealth that run contrary to their expected standard of living amidst Russia's economic turmoil.[37] So, these holdovers may not only be driven by a desire to preserve a weapons capability, they may also have a profit motive for remaining in power.

Next, the chemical and biological weapons complexes—flush with resources during the Soviet era—have fallen upon very hard economic times. The USSR Ministry of Defense funded about three-quarters of *all* scientific research. After 1991, monetary support for the weapons institutes all but disappeared. Since "everything cracked," the Russian Research Center for Molecular Diagnostics and Therapy and the Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry have received only 5 percent of their Soviet-era

---

"Recently, the FCS role within GosNIIOKhT was strengthened. The deputy director of security, a colonel in the FCS by the name of Martinov, was moved to the position of chief of GosNIIOKhT's personnel department. Martinov was replaced by another FCS colonel, Stepanov. Many of Petrunin's colleagues who have great interest in seeing a covert chemical weapons program continue are also still there too." Dr. Vil Mirzayanov, 28 April 1999 interview with the author.

[35] Dr. Ken Alibek, interview with the author, 5 June 1999.

[36] Rimmington, "From Military to Industrial Complex?" 84. See also, pages 83 and 87 of this article.

[37] "Now," Alibek notes, "Russia is absolutely and completely corrupted." Dr. Ken Alibek, interview with the author, 6 May 1999. Also, biological institute director, 17 September 1999 interview with the author; ISTC staff members, 15 and 17 September 1999 interviews with the author.

stipends—hardly enough to pay the light bill. GosNIIOKhT, the premier poison gas research institute, saw its budget cut by a factor of ten, and the State Research Center for Applied Microbiology at Obolensk got four times more government support at the beginning of the 1990s than it did at the end of the decade.[38] Within the biological and chemical complexes, institutes were forced to cut personnel by the thousands. The Scientific Agricultural Research Institute in Kazakhstan laid off half of its 150-person staff, and the All-Russian Institute of Phytopathology in Golitsino saw its staff strength plunge from 1,200 to 276.[39] Other examples of personnel cuts are documented in Table 1.[40] Remaining on the payroll turned out to be a small victory, for salaries for scientists dipped as low as $50 to $25 per month for some, even much, much less for others.[41]

Many institutes apparently have unable to pay their remaining personnel on a regular basis throughout the 1990s. For example, the All-Russian Institute of Phytopathology in Golitsino could only pay its remaining employees occasionally, and the branch of GosNIIOKhT located at Shikhany could not provide paychecks for its staff from

---

[38] The deputy director of a biological institute used the phrase "everything cracked" to describe what happened after the Soviet government dissolved in an interview with the author, Moscow, 16 September 1999. Also, chemical institute director, interview with the author, Moscow, 15 September 1999; senior biologist, interview with the author, Moscow, 16 September 1999; biological institute deputy director, interview with the author, Moscow, 17 September 1999.

[39] Miller, "Long Island Lab May Do Studies," A1**;** Judith Miller and William J. Broad, "Iranians, Bioweapons in Mind, Lure Need Ex-Soviet Scientists," *New York Times,* 8 December 1998, A1.

[40] One ISTC staffer observed that these institutes would emerge from this transition more self-sufficient if their staffs were pared down even further, for the Soviet institutes were truly bloated in comparison to scientific centers in the West. ISTC staff member, 17 September 1999 interview with the author.

[41] In 1995, the pay at GosNIIOKhT was 275 rubles for a technician and 500 to 600 rubles per month for a senior scientists. Chemist, interview with the author, Moscow, 15 September 1999. The exchange rate as of 31 December 1995 was $1 to 4,650 rubles. In other words, even GosNIIOKhT's senior scientists were getting paid *less than a dollar per month*. Other salary rates were provided by a biological institute deputy director, 17 September 1999 interview with the author; ISTC staff member, interview with the author, Moscow, 20 September 1999.

Table 1: Personnel Cuts at Some Chemical and Biological Institutes After the Soviet Collapse.

Institute	1990 Staffing Level	1999 Staffing Level
GosNIIOKhT, *Moscow*	3,500	1,500
State Research Center for Applied Microbiology, *Obolensk*	3,000	1,200
State Research Center for Virology and Biotechnology (Vector), *Koltsovo*	4,000	2,000
Institute of Highly Pure Biopreparations, *St. Petersburg*	500	250*
Institute of Immunological Engineering, *Lyubuchany*	480	120**
Russian Research Center for Molecular Diagnostics and Therapy, *Moscow*	600	150
Institute of Bioorganic Chemistry, *Moscow*	1,000	1,000†

* The Institute of Highly Pure Biopreparations was able to rehire one hundred staffers in 1998 and 1999 because of grant support from the ISTC.
** Lyubuchany has thirty-five to forty scientists, sixty engineering support staff, and about twenty technicians and assistants.
† This institute is an educational and training facility with about three hundred scientists on site.
Sources: Senior chemist, interview with the author, Moscow, 15 September 1999; biological institute deputy director, interview with the author, Moscow, 16 September 1999; senior biologist, 16 September 1999 interview with the author; head of biochemistry laboratory, 17 September 1999 interview with the author; biological institute general director, 17 September 1999 interview with the author; head of laboratory, 17 September 1999 interview with author; biological institute deputy director, 17 September 1999 interview with the author.

March until at least September of 1999.[42] The scientists at Obolensk went without their government pay for months in the fall of 1999.[43] Furthermore, working conditions at the institutes became truly spartan. With economic circumstances so dire, one could enter a weapons institute as early as 1997 to find a scribbled message inviting the remaining staff

[42] Miller and Broad, "Iranians, Bioweapons in Mind," A1; chemical institute director, 15 September 1999 interview with the author.

[43] Biological institute director, 17 September 1999 interview with the author.

"to pick potatoes on Thursday, when a truck will be available to transport them."[44] In one Moscow-area facility, unpaid scientists worked through the winter of 1999 in unheated laboratories, with some equipment not functioning because the temperatures were below 50 degrees Fahrenheit.[45]

While there has been no indication that any chemical weapons scientists have gone astray, reports surfaced in the late 1990s about possible leaks from the Russian biological weapons complex.[46] One leak sprung in 1994 when scientists from Moscow's Gamalaya Institute of Epidemiology and Microbiology spent a year working in Iran.[47] Iran was routinely described as the country most aggressively recruiting Russian bioweaponeers, offering the princely sum of $50,000 annually if they would work with infectious diseases.[48] Iranian recruitment efforts have reportedly been successful. A January 1999 report of the National Council of Resistance stated that Iran signed several Russian bioweaponeers to a one-year contract, and the Russian newspaper *Kommersant* reported in its 26 January 1999 edition that a Russian scientific delegation traveled to Tehran and gave data on anti-crop agents to the Iranians.[49] The *New York Times* reported that at least five Russian germ warfare experts had gone to work in Iran, which paid the Russians $5,000 per month as opposed to their regular $100 monthly salary.[50]

---

[44] "Science in Russia," *The Economist*, 25.

[45] ISTC staff member, 16 September 1999 interview with the author.

[46] For instance, forty scientists from the Russian Academy of Sciences Siberian Department's Institute of Cytology and Genetics in Novosibirsk reportedly emigrated to Brazil to work at a pharmaceutical company. Rimmington, "From Military to Industrial Complex?" 96.

[47] U.S. government official, interview with the author, Washington, D.C., 24 May 1999.

[48] Senior biological researcher, interview with the author, Moscow, 17 September 1999. Iranian president Ali Akbar Hashemi Rafsanjani has stated that Iran "should at least consider biological weapons" for its defense. According to the *London Times*, "Iran has targeted the Russians very well. They have gone straight for the best people in the Russian biological weapons program. They have saved years of experiments and have been able to go straight from basic research to production, and the development of an effective delivery system." James Adams, "Russia Helps Iran's Bio-warfare," *London Times*, 27 August 1995.

[49] Tucker, "Bioweapons in Russia,"36. The *New York Times* also reported that the Iranians had a particular interest in anti-crop and anti-animal pathogens. Miller, "Long Island Lab May Do Studies," A1.

[50] Other Russian experts are reportedly on the Iranian payroll, but remain in Russia. Miller and Broad, "Iranians, Bioweapons in Mind," A1.

Some experts have viewed these stories as exaggerations, but the director of a biological institute and more than one U.S. government official called the *Times* article accurate, "an exceptional piece of reporting."[51] Confirming the general nature of these reports, Russian biologists recalled colleagues who had gone to Iran to conduct AIDS research and teach, including one from Obolensk who had subsequently returned to Moscow. Another scientist knew of a colleague from Vector heading to Iran and several scientists from the Radiotechnical Institute in Moscow to North Korea.[52]

With circumstances at the weapons institutes so dire, some chemical and bioweaponeers have been forced to take other jobs to support their families. The senior chemists at Shikhany, for instance, were hunting for jobs, a situation that is particularly challenging since GosNIIOKhT is the main employer in the area.[53] Of the weaponeers that left the various institutes, the engineers reportedly obtained jobs at Moscow-area biotechnology companies and the scientists ended up working at banks or in the computer industry.[54] The news is mostly positive in that regard, but reports have emerged of weapons specialists trying to profit from their access to sensitive materials and equipment.

Those intent on selling equipment, chemical or biological agents, and weapons cookbooks may find few stiff impediments, given the degrading security and accountability at the facilities concerned. Chemical and biological facilities may be ripe targets for criminal gangs, terrorists, and opposing political camps during civil disputes.[55] All the

---

[51] "I don't take issue with anything that [the *New York Times*] wrote." U.S. government official, 19 May 1999 interview with the author. A similar statement was made by another U.S. government official in a 24 May 1999 interview with the author. Confirmation of the article's accuracy also came from the general director of a biological institute in a 17 September 1999 interview with the author.

[52] The interviewees were convinced that these scientists were unaware that they were being recruited for weapons work. "They are doing scientific work and they don't know that they are working against our country, especially now after Russia's recent experiences with terrorists from Chechnya." Biological institute deputy director, 17 September 1999 interview with the author. Also, head of laboratory, interview with the author, Moscow, 16 September 1999; ISTC staff member, 16 September 1999 interview with the author.

[53] Chemical institute director, 15 September 1999 interview with the author.

[54] Senior biologist, 16 September 1999 interview with the author.

[55] Analyst William Potter noted the problems inherent in the "young, poorly paid guards" at the military facilities: "They are largely ignorant about proliferation concerns and are exceptionally vulnerable to recruitment by organized crime." As quoted in Richard Stone, "RUSSIA: Nuclear Strongholds in Peril,"

ingredients for successful black marketeering are present throughout the chemical and biological complexes—under- or unemployed scientists and managers, valuable commodities at far-flung locations, and poor security. In December 1997, Interior Minister Anatoly Kulikov observed that approximately $30 billion in illegal imports and exports crossed Russia's border's in 1997, an underground market totaling 40 percent of Russia's economy.[56] The assessment of one scholar was as follows: "Given the ineffective enforcement of export controls which is likely to exist in Russia and the other Soviet successor states there must be some considerable risk that pathogenic strains seized from poorly secured culture collections belonging to [biological weapons] facilities could be exported internationally."[57]

One of the first individuals to fall under suspicion of proliferation profiteering was the original chief of the presidential committee, Gen. Anatolii Kuntsevich, whom Yeltsin fired in April 1994 for "numerous and gross violations" of his responsibilities once it became known that he agreed to sell equipment and chemical precursors to a Syrian laboratory.[58] In another case, United Nations Special Commission inspectors uncovered evidence that in 1995 some Russians agreed to sell Iraq fermentation equipment, including a 5,000 liter vessel.[59] The U.S. intelligence community also asserted that some time in the late 1980s or early 1990s the highly contagious virus smallpox found its way from Russia

---

Science 283, no. 5399 (8 January 1999): 164. Unauthorized personnel reportedly gained access to the Institute of Experimental Pathology and Therapy in Sukhumi, Georgia, seizing plague and cholera from its culture collection. In 1995, plague, cholera, and anthrax cultures were reportedly stolen from a Kazakh anti-plague institute so that they could be unleashed in a terrorist attack on the city Khabarovsk. Anthony Rimmington, "Fragmentation and Proliferation? The Fate of the Soviet Union's Offensive Biological Weapons Programme," *Contemporary Security Policy* 20, no. 1 (April 1999):100. On the serious security problems at Russia's chemical weapons storage sites, Amy E. Smithson, "Improving the Security of Russia's Chemical Weapons Stockpile," in *Chemical Weapons Disarmament in Russia*, 5–20.

[56] Jim Hoagland, "Hammering at Russia," *Washington Post*, 8 January 1998, A21.

[57] Rimmington,"Fragmentation and Proliferation?" 99.

[58] Sonni Efron, "Russia Investigates Alleged Chemical Arms Smuggling," *Los Angeles Times*, 25 October 1995, A4.

[59] This equipment was supposedly destined for Al Hakam, a facility proven to be at the center of Iraq's biological weapons program and destroyed by United Nations inspectors in June 1996. R. Jeffrey Smith, "Did Russia Sell Iraq Germ Warfare Equipment? Document Seized by U.N. Inspectors Indicates Illicit Deal," *Washington Post*, 12 February 1998, A1.

to Iraq and North Korea.[60] Strains of smallpox are among approximately 15,000 seed cultures housed at the State Research Center for Virology and Biotechnology, known as Vector, in Koltsovo.[61] Other worrisome assertions include one about company associated with the anti-plague institute in Almaty, Kazakhstan. This company, called VIVA, might have peddled plague to militants who subsequently used it to instigate a 1994 outbreak of the disease in India.[62] Another company, Bioeffect, Ltd., issued a flier advertising a "cooperation opportunity" involving genetically altered strains of tularemia, describing possibilities for sales, licensing, and joint ventures.[63] Further giving the impression that the weapons institutes were porous, stories began to circulate of vials containing seed cultures being stashed inside of ordinary plastic cigarette packages so that disease strains could be smuggled out of biological institutes.[64]

Other than the trafficking of equipment and sensitive materials, the main concern is that former Soviet chemical and bioweaponeers will sell their specialized expertise and weapons formulas to aspiring proliferators.[65] By 1995, some three hundred former scientists from Biopreparat had already emigrated to the United States and Europe, but no one was able to tally how many might have gone to countries of proliferation concern. Russia's

---

[60] William J. Broad and Judith Miller, "Government Report Says 3 Nations Hide Stocks of Smallpox," *New York Times,* 13 June 1999, A1.

[61] The World Health Organization conducted a global campaign to eradicate smallpox in the 1960s and 1970s, declaring victory over the disease in 1978 and leaving only two official repositories of smallpox—reference strains at the Centers for Disease Control in Atlanta and at Vector in Russia. The belief that additional laboratories in Russia and elsewhere have also obtained smallpox has led to a postponement of the destruction of the official stocks that the World Health Organization helps oversee in Atlanta and Vector. See David Brown, "Destruction Of Smallpox Samples Is Reassessed," *Washington Post,* 15 March 1999, A1; Lawrence K. Altman, William J. Broad, and Judith Miller, "Smallpox: The Once and Future Scourge?" *New York Times,* 15 June 1999, F1.

[62] An Indian official stated that the strain from the outbreak in Surat was not endemic, leading to suspicions that the militants might have purchased that strain from the Almaty company. Kazakh officials deny these allegations. Rimmington,"Fragmentation and Proliferation?" 100.

[63] Through this advertisement, the Director of Bioeffect, Nikolay N. Kislitchkin, sought joint ventures and licensing arrangements. Mimeo copy of the advertisement, n.d.

[64] Tucker, "Bioweapons from Russia," 36–7.

[65] In March 1992 the former director of Obolensk, Igor V. Domaradskij, offered his skills to the Chinese and to the Kalmyk Republic, but neither responded. Domaradskij recounts this tale in his unpublished 1995 autobiography, *Troublemaker: The Story of an "Inconvenient" Man.* Mimeo of English translation.

weaponeers need not leave the country to aid proliferators. Modern technology makes it possible for cash-strapped scientists to "moonlight by modem," sharing weapons secrets with other governments, terrorist groups, or other interested bidders via e-mail or facsimile.[66] One of the developments that may indicate that a market economy is taking hold within the biological and chemical complexes, the creation of joint stock companies and other research and marketing ventures that conduct business with firms abroad, may make it more difficult to track the whereabouts of people, sensitive materials, and dual-use equipment.[67]

[66] The problem of moonlighting by computer was raised by Alan Cooperman and Kyrill Belianinov in "Moonlighting by Modem in Russia: Hard-up Scientists Sell Their Skills Abroad," *U.S. News & World Report* 7 (17 April 1995): 45–8.

[67] Rimmington, "Fragmentation and Proliferation?" 95.

INTO THE BREACH

The International Science and Technology Center was chartered to fund scientific research in order to stem the flow of weapons expertise and materials from the former Soviet Union.[68] Following its first board meeting in March 1994, the ISTC began issuing grants to nuclear, chemical, and biological scientists and missiliers. The ISTC's objectives are:

- to provide [former Soviet] weapons scientists the opportunity to redirect their talents to peaceful activities;
- to support basic and applied research and technology development;
- to contribute to the transition to market-based economies;
- to help integrate [former Soviet] scientists and engineers into the global scientific community; and,
- to contribute to solving national and international technical problems.[69]

With its initial tranche of grants, the ISTC began a first-of-its-kind venture in the field of nonproliferation. The organization would attempt to use joint research opportunities and funds to help weapons experts transition to new and peaceful ways of making a living. As such, the ISTC was a novelty for sponsor and recipient countries alike, as well as the scientists on both sides who became involved in the endeavor.

The ISTC operates under agreements with host governments that ensure its tax-exempt status and confer rights to audit the research grants. Scientists from Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, and Uzbekistan are participants in the ISTC's grant program.[70] Roughly 150 individuals work at the ISTC's Moscow headquarters, helping with proposal preparation,

---

[68] Japan, the European Union, Russia, and the United States signed an agreement setting the terms for the ISTC in November 1992, but the Duma balked at considering it until late in 1993. The first ISTC Board of Governors meeting was held in March 1994. Victor Alessi and Ronald F. Lehman II, "Science in Pursuit of Peace: The Success and Future of the ISTC," *Arms Control Today* 28, no. 5 (June/July 1998): 18–9. For an account of the difficulties involved in starting the ISTC, see R. Adam Moody, "The International Science Center Initiative," in John M. Shields and William C. Potter, eds., *Dismantling the Cold War: U.S. and NIS Perspectives on the Nunn-Lugar Cooperative Threat Reduction Program* (Cambridge: MIT Press, 1997): 251–89.

[69] *U.S. Government Assistance to and Cooperative Activities with the New Independent States of the Former Soviet Union: FY 1997 Annual Report*, Report to Congress Submitted Pursuant to Section 104 of the Freedom Support Act (Washington, D.C.: U.S. Department of State, January 1998): 134–5.

[70] *International Science and Technology Center 1998 Annual Report* (Moscow: International Science and Technology Center, 1999), 6.

managing approved projects, and auditing the progress of research grants.[71] The ISTC also has branch offices in Minsk, Yerevan, and Almaty. From 1994 to 1998, the ISTC sponsored over 650 research projects with 24,000 nuclear, missile, chemical, and biological weapons scientists at nearly three hundred institutes. The value of these grants came to just under $190 million.[72]

The idea of applying for research grants from the ISTC was quite foreign to the scientists in the chemical and biological institutes. These scientists were accustomed to money and missions that "just came from the sky," not to the procedures and scrutiny of a grant application process.[73] So novel was the grant process that some institutes were at first suspicious of the ISTC. American, British, French, German, and South Korean entrepreneurs approached several institutes in the early 1990s on the pretext on starting a contractual relationship, only to steal the ideas that the naive scientists wrote down for their consideration. Once the weapons scientists were introduced to the concepts of patents and intellectual property rights, they became leery of dubious offers.[74] Accordingly, when the ISTC first knocked on their doors, many scientists were wary.

The first step for scientists seeking ISTC grants is to secure the concurrence of their own government.[75] This step is apparently not as onerous for scientists from the chemical weapons institutes because their counterparts in the biological institutes must have their proposals reviewed first by Biopreparat, ostensibly to ensure that the proposed work does not compromise defense secrets. Some uncertainty exists as to whether Biopreparat requires

---

[71] The ISTC's multinational staff includes six Americans. Senior ISTC staff member, interview with the author, Moscow, 20 September 1999.

[72] *1998 ISTC Annual Report*, 1, 20.

[73] The phrase used to describe the institutes' dependency on government funding was uttered by a biological institute deputy director, 16 September 1999 interview with the author. Similar thoughts were voiced by an ISTC staff member, 20 September 1999 interview with the author.

[74] Some institute directors and scientists did not trust the ISTC and its funding governments because they had heard lots of promises from Western companies and "still not a nickel." ISTC staff member, 15 September 1999 interview with the author. Also, biological institute deputy director, 16 September 1999 interview with the author; biological institute director, 17 September 1999 interview with the author.

[75] Alessi and Lehman, "Science in Pursuit of Peace," 19. The Russian government approves all Russian scientific proposals before they are submitted to the ISTC, sometimes indicating verbally or in writing which of the proposals it thinks ought to be priorities for ISTC funding. U.S. government official, 19 May 1999 interview with the author.

all or just some of the biological institutes to submit their proposals for this pre-screening process, which takes anywhere from two to four months.[76] The formal vetting of chemical and biological proposals is done mostly by the Ministry of Science and Technology, which has a committee of experts for that purpose, although the Academy of Sciences and the Ministry of Economy also occasionally review grant proposals. Some proposals are quickly approved in a month or two, but others languish in governmental review for over a year.[77]

Since the Ministry of Atomic Energy is the host for the ISTC, providing the office space, one might expect to find some bias against non-nuclear grants in Moscow. While the directors of the nuclear facilities have frequently voiced objections at the shift of funds toward the biological institutes, the government officials appear not to favor nuclear research over chemical or biological projects. In fact, a prominent atomic ministry official involved in the ISTC's work has advocated vaccine projects and other non-nuclear research pointing to benefits those grants will produce for the Russian economy.[78]

When a government sanctions a proposal, it forwards that proposal to the ISTC with a certification that the scientists requesting ISTC grant support are weaponeers.[79] Upon

---

[76] ISTC staff members, 15 and 20 September 1999 interviews with the author; biological institute deputy director, 16 September 1999 interview with the author.

[77] Senior chemist, 15 September 1999 interview with the author; senior ISTC staff member, 16 September 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author. According to one veteran of this process, the Ministry of Science and Technology has been known to hold proposals for as long as a year, demanding many revisions. This individual described the Ministry of Science and Technology as "sort of enemies" of the ISTC and its host Russian government agency, the Ministry of Atomic Energy. Apparently, the Ministry of Science and Technology lost to MINATOM in the competition to be the ISTC's host. Biological institute deputy director, 16 September 1999 interview with the author. Other scientists said that they experienced waits that averaged six months or longer for Ministry of Science and Technology approval. Senior biologist, 16 September 1999 interview with the author; head of laboratory, 17 September 1999 interview with the author. The chemical and biological institutes are also periodically reviewed by the government for accreditation, a process in which the Ministry of Science and Technology takes a leading role. To be certified as a scientific center, an institute's scientists must produce and publish scientific results, among other activities. The government provides little funding for their work but still expects results, a situation that is quite stressful for the scientists at the institutes, which will lose their accreditation if their performance declines. ISTC staff member, 16 September 1999 interview with the author.

[78] U.S. government official, 19 May 1999 interview with the author.

[79] The ISTC sometimes asks its funding governments to confirm some certifications, since a host government may have reasons to hide the true extent of a scientist's background. For instance, a scientist's weapons credentials could be exaggerated to make him or her a more attractive grant candidate. Conversely, a government still trying to maintain a weapons capability might downplay the roles of some scientists.

receipt, the ISTC registers the proposal.[80] Over the next several months the ISTC's staff works with prospective project managers to help them sharpen cost estimates, and, if necessary, give poorly written proposals a linguistic scrub.[81] Another proposal preparation task that preoccupies the ISTC's project managers is the identification and recruitment of outside scientific collaborators for proposed projects. Initially, the ISTC awarded the majority of its grants to former Soviet scientists working in conjunction with each other. The dual-use nature of proposed biological projects, however, compelled the ISTC Board of Governors to articulate a policy requiring all proposed biological projects to have an "active" Western partner "to help ensure that the research was civilian in nature, but [also] to provide linkages into the international scientific community that could help former Soviet [biological weapons] experts explore alternative research areas into which they could redirect their skills."[82] No similar requirement exists for chemical proposals.

Accompanied by a brief appraisal from the ISTC staff, proposals are next sent to the funders for separate evaluations of whether and to what extent a proposal should be funded.[83] The ISTC Board of Governors, which meets on a quarterly basis, has ninety days to complete the initial review each proposal. The ISTC's funders are the European Union, Japan, Norway, South Korea, and the United States.[84] These funding sources are diagramed

---

Senior ISTC staff member, 20 September 1999 interview with the author.

[80] Note that the ISTC refuses to register a proposal if the institute involved does not sign an agreement with the ISTC allowing technical and fiscal monitoring of the grant or if the proposal is for something ridiculous and outside of the ISTC's purview, such as a $1 million grant to build an automobile manufacturing plant. Senior ISTC staff member, 16 September 1999 interview with the author.

[81] Some proposals require major reworking because many of the scientists have very poor English skills, and bad translation has garbled what would otherwise be good science. Senior ISTC staff member, 16 September 1999 interview with the author. The recommended funding breakdowns for a research project are 50 percent of costs to personnel salaries, 20 to 25 percent to equipment purchases, 10 percent to travel, and 10 percent to overhead. ISTC staff member, 15 September 1999 interview with the author.

[82] Anne M. Harrington, "Redirecting Biological Weapons Expertise: Realities and Opportunities in the Former Soviet Union," *Chemical Weapons Convention Bulletin*, no. 29 (September 1995): 3.

[83] This evaluation includes whether the proposal met the ISTC's formal criteria, an evaluation of its financial aspects, and sometimes a review of its scientific merit. Senior ISTC staff member, 16 September 1999 interview with the author.

[84] The funders meet often to make sure they remain in agreement on the ISTC's nonproliferation priorities. Japan has tended to emphasize funding projects according to the domestic source of their funds, focusing on nuclear projects if the Japan Atomic Energy Research Institute is providing the funds. In a few cases, when other funders have initially voiced support for projects that the U.S. government did not favor, they have rejected those projects after U.S. officials share information that explains why a proposal should

in Figure 2, which provides additional detail about the organizations within the U.S. government involved in the ISTC's work. The governments working with the ISTC, which often have policy differences about other international issues, reportedly tend to get along with "extraordinary collegiality" when it comes to the ISTC affairs.[85]

In the United States, proposals are received by the State Department's Office of Proliferation Threat Reduction, Bureau of Nonproliferation, and then fanned out to the branches of the U.S. government best suited to evaluate their technical caliber. These technical evaluations consider not only scientific merit, but practicality, prospects for commercialization, number of weapons scientists involved, and other nonproliferation aspects as well.[86] While chemical projects are reviewed mostly by specialists from the Defense and Energy Departments, biological proposals may be sent to the Departments of Defense, Agriculture, and Health and Human Services.[87] These technical evaluations are factored into a monthly interagency policy review, the Nonproliferation Roundtable, that assigns a final priority rating to each ISTC proposal. An important consideration in this policy review is the intelligence community's nonproliferation assessment of whether the scientists and/or institutes involved are still believed to be engaged in offensive weapons activities.[88]

---

not be approved. U.S. government official, interview with the author, Washington, D.C., 13 April 1999; former U.S. government official, 13 April 1999 interview with the author.

[85] Former U.S. government official, 13 April 1999 interview with the author; U.S. biodefense expert, 21 May 1999 interview with the author; U.S. government officials, 19 and 24 May 1999 interviews with the author.

[86] Alessi and Lehman, "Science in Pursuit of Peace," 20.

[87] The Defense Department, which uses Cooperative Threat Reduction program funds to support ISTC grants, asks for technical reviews of biological proposals from the U.S. Army Medical Research Institute of Infectious Diseases, the National Academy of Sciences, the Defense Advance Research Projects Agency, the Agricultural Research Service, and CRDF. The State Department farms proposals to nuclear, chemical, biological, and missile scientific advisory panels, each consisting of four scientists in the Department of Energy's laboratories, who supervise technical peer reviews by at least two other specialists. The CRDF and the Soldier and Biological Chemical Command also evaluate proposals for the State Department. The Department of Health and Human Services has a full-time administrator to supervise biological grants and utilizes an advisory committee of seventeen scientists, as well as the Centers for Disease Control, for its technical reviews. The Agricultural Research Service also has a full-time administrator, who turns to a committee of eight scientists to review proposals. U.S. government officials, 19 and 24 May 1999 interviews with the author.

[88] U.S. government officials, 19 and 24 May 1999 interviews with the author.

The ISTC board makes several types of decisions about proposals. The Governing Board can postpone considering a proposal, send it back to the applicant for revision, request that the applicant find scientific collaborators, reject a proposal, approve a proposal with an identified funding date, or approve a proposal but delay specific funding allocations. Financial support for an approved proposal can come solely from one country or jointly from two or more funders.[89] Although scientists complain that they do not get feedback from the ISTC on the status of their application,[90] the ISTC sends the scientists letters informing of them that the board has declined their proposal, deferred its consideration, or approved it for funding.[91] According to some scientists, getting the grant initiated *after* the

[89] For example, the U.S. government will not offer to fund a project by itself unless 50 percent of the scientists participating are weapons specialists. If the proposed project is sound but less than 50 percent of the participating scientists are weaponeers, the U.S. board member is instructed to seek co-funding from other ISTC sponsors. U.S. policy is not to support proposals from institutes or individuals that the U.S. government believes to be involved in offensive weapons work. The reasons for declining support for a proposal are communicated to the scientists and/or institute involved. In some cases, U.S. officials have observed subsequent changes in behavior that have allowed ensuing proposals to be considered in a more favorable light. At times, the U.S. government will also ask the scientists proposing a project to compare it with other similar proposals and/or to reduce a project's costs before it can be further evaluated for support. Former U.S. government official, 13 April 1999 interview with the author. An approved, unfunded proposal can be carried for three board cycles. Senior ISTC staff member, 20 September 1999 interview with the author. Details of the ISTC board's decision-making process were also provided by an ISTC staff member in a 15 September 1999 interview with the author.

[90] One described this process as a "black box." Head of biochemistry laboratory, 17 September 1999 interview with the author. Other scientists voiced similar concerns. Senior chemist, 15 September 1999 interview with the author; senior biologist, 16 September 1999 interview with the author, Moscow.

[91] ISTC staff member, 15 September 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author.

approval notice can take as long as one and a half years.[92] At this stage of the process, recipient scientists are asked to prepare a plan of work that adjusts their research plan according to the board's instructions. For instance, the board may direct a more narrow scope of work or fund the proposal for less money than was requested. Drafting this plan of work can be a time-consuming process because the revisions involve the scientists, the ISTC staff, the project's scientific collaborators, and the funding governments. Everyone must concur on the plan of work before an agreement can be signed that releases funding for research and salaries.[93] The ISTC inaugurates from ten to fifteen projects per month.[94]

Scientists describe applying for an ISTC grant as an ordeal, one that sometimes stretches to three years. "It doesn't appear reasonable to take three years to get the contract started when the project only lasts two years."[95] Apparently, the scientists, the host and funding governments, and the ISTC all share blame for the inordinate length of the grant approval process. Sometimes, a proposal can get held up in host-government approval, taking more than a year just to get to the ISTC's doorstep. Next, the scientists themselves are at fault when they allow months to pass before making the simple revisions that the ISTC requests. Those who submit well-written and costed proposals and complete requested revisions quickly can polish a proposal in less than five months and a plan of work even more quickly.[96] Although the funding governments can review proposals in as little as three months, the scientists describe how some proposals disappear into a black hole as the funders keep them from nine to twelve months during both the initial review and the post-approval revision stages. Also liable is the ISTC staff, which has been criticized for

---

[92] Senior chemist, 15 September 1999 interview with the author; senior biologist, 16 September 1999 interview with the author.

[93] Senior ISTC staff members, 16 and 20 September 1999 interviews with the author.

[94] Senior ISTC staff member, 20 September 1999 interview with the author.

[95] Senior chemist, 15 September 1999 interview with the author. Others experienced waits from two to three years. Head of laboratory, 16 September 1999 interview with the author; biological institute general director, 17 September 1999 interview with the author; head of a biochemistry laboratory, 17 September 1999 interview with the author. Apparently, the grant approval process was quicker in 1994 an 1995, allowing grants to get started in approximately six months.

[96] When asked to make a minor change, some scientists apparently respond with a letter informing the ISTC that they will begin to consider the requested change the following week. Other scientists finish the changes overnight. ISTC staff member, 15 September 1999 interview with the author; ISTC staff member, 16 September 1999 interview with the author. Adept scientists also interact with their governmental contacts to move along the host government approval process. Biological institute director, interview with the author, Moscow, 17 September 1999.

lethargic handling of some proposals and not dispensing funds promptly after project agreements are signed.[97] To cut down on delays, the ISTC has begun allowing scientists to file their proposals electronically, which in turn enables the ISTC to send proposals to the funders electronically. The proposal format has also been altered to facilitate the drafting of a subsequent plan of work, and the ISTC has created a model project agreement.[98]

Additional "Brain Drain" Prevention Programs

The ISTC is undoubtedly the largest of the brain drain prevention programs, other grant programs were created in the 1990s to address the human element of the proliferation dilemma. These programs include the ISTC's sister organization, the Science and Technology Center in Ukraine, the Civilian Research and Development Foundation, the Initiatives for Proliferation Prevention program, and scientific grant programs funded by the European Union. In turn, this section of the report describes the scope and operation of each of these brain drain prevention programs.

The operational approaches of the IPP, ISTC, STCU, and CRDF programs each have advantages and drawbacks. Of the these efforts, bilateral politics are most likely to come into play in the IPP program, which operates predominantly on a U.S.–Russia axis. In comparison, the CRDF's scientist-to-scientist mode of operation virtually frees its grant activities of international politics. Also, the ISTC and STCU have status as international organizations with the host governments and the weapons institutes. Because bilateral political politics can be muted in a multilateral context, it is sometimes easier for the STCU and ISTC to gain entree to certain facilities. Various aspects of the major scientific grant assistance programs in which the United States participates are laid out in Table 2.

---

[97] U.S. government official, 24 May 1999 interview with the author.

[98] ISTC staff member, 15 September 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author.

Table 2: Summary of the Features of the Brain Drain Prevention Programs.

Feature	ISTC	IPP	CRDF
Initiation date	1994	1994	1995
U.S. Government Proposal Review Process	State Department sends to reviewers from the Defense, Energy, Agriculture, and Health and Human Services Departments; vetted through Nonproliferation Roundtable	National laboratory and industry experts review; vetted through Nonproliferation Roundtable	Six expert committees; proposals with weaponeers vetted through Nonproliferation Roundtable
Operating Framework	Government-to-government Agreements	Under negotiation*	Memoranda of Understanding
Tax-exempt status	Yes	No*	Yes
Travel Grants for Scientists	Yes	No**	Yes; also administers ISTC travel grants
Commercialization Activities	Partners program	Phase II and Phase III grants	Next steps to market program
Collaborator Participation	Unpaid	Paid over 60 percent of grant value***	20 percent of grant to U.S. collaborator; restricted to travel, small reimbursable expenses
Training Programs	Yes; examples include business and management; Good Laboratory Practices; Good Manufacturing Practices; animal standards	Indirect through grant activities	Yes; examples include business and management
Funding Sources	European Union, Japan, Norway, South Korea, United States; industry partners	Energy and Water Appropriations Act (1996 to present); industry partners	Freedom Support Act, National Institutes of Health, National Science Foundation, MacArthur Foundation, industry partners, host governments
Audit Procedures	Formal quarterly financial audit, subsequent payment to scientists; major equipment purchases via ISTC; on-site technical monitoring, close-out financial audits; post close-out audit rights	Indirect; payment to scientists after deliverables*	Quarterly monitoring via progress reports, subsequent payment to scientists; bank audits; on-site monitoring visits

Note: The ISTC and STCU operate in a similar manner.
* The IPP program is in discussion with the governments of Kazakhstan, Russia, and Ukraine for tax-exempt status. Until this status is secured, IPP plans to use CRDF as its funding mechanism.
** IPP has no formal travel grant program, although recipient scientists can include travel, as appropriate, in their project proposals.
*** See *Concerns With DOE's Efforts to Reduce the Risks Posed by Russia's Unemployed Weapons Scientists*, GAO/RCED–99-54 (Washington, D.C.: General Accounting Office, February 1999), 3, 31–2. The IPP program has instituted reforms to increase the percentage of funds reaching former Soviet weapons scientists.

While at first many of the scientists were intimidated by or distrustful of getting grants from outsiders, before long they were searching for funding from multiple sources. Scientists from the biological and chemical institutes reported receiving grant assistance from the IPP program and from the European Union. They have applied for grants from CRDF. Observed the director of one biological institute, "They are competing for everything, looking for every foundation."[99] For instance, over a three year period, scientists at the Lyubuchany Institute of Immunological Engineering have received $1 million in ISTC grants, augmented with additional funding from the National Aeronautics and Space Agency, the Soros Fund, a European Union scientific grant program, and the British Royal Society. These funds have enabled Lyubuchany to scrape through, enabling laid off researchers to return to the institute.[100] The government financial umbilical cord having been cut, there are signs that the scientists and their institutes are learning to compete and fend for themselves in the grant arena. These signs bode well for more ambitious efforts to redirect the weapons institutes, such as creating profitable commercial spin-off firms.

The Science and Technology Center in Ukraine

The Science and Technology Center in Ukraine opened its doors in July 1995 with the same purpose as its sister organization, the ISTC.[101] The STCU issues grants to former weaponeers in three countries: Georgia, Ukraine, and Uzbekistan. Accordingly, the STCU has a staff of around forty, less that one-third the size of the ISTC. The STCU works in essentially the same manner as the ISTC, with agreements with governments that provide tax-exempt status. Like the ISTC, the STCU has a Governing Board composed of the organization's funders that reviews research proposals and makes funding decisions. From 1994 to 1998, the STCU oversaw the disbursal of over $27 million in grants, reaching close to 4,500 Georgian, Ukrainian, and Uzbek scientists through 217 research projects.[102]

---

[99] Biological institute general director, 17 September 1999 interview with the author. Others who expressed similar thoughts were a senior chemist, 15 September 1999 interview with the author; head of laboratory, 16 September 1999 interview with the author; biological institute deputy director, 16 September 1999 interview with the author.

[100] Rimmington, "From Military to Industry Complex?" 97.

[101] An October 1994 agreement established the STCU, but several months passed before the organization became operational. *1997 Annual Report on U.S. Government Assistance to and Cooperative Activities,*134.

[102] Science and Technology Center Ukraine. Internet: http: www.stcu.kiev.ua. Downloaded 18 November 1999.

The STCU's first funders were Canada, Sweden, Ukraine, and the United States, with the European Union joining the organization in December 1998. The United States has underwritten the lion's share of STCU activities, contributing $21.4 million through 1998, or roughly 80 percent of the budget.[103] The European Union provided $3.1 million for the 1999 round of STCU grants, which were announced in May 1999.[104] The STCU Governing Board approved twenty-four new projects valued at $3.7 million. Two-thirds of the scientists receiving these grants were categorized as having expertise in weapons of mass destruction technology or delivery systems.[105]

The Civilian Research and Development Foundation

In 1995, the National Science Foundation established a scientific grant program called the Civilian Research and Development Foundation that complements the work of the ISTC. The CRDF pairs former Soviet scientists in active partnerships with U.S. scientists to promote collaborative, peaceful research.[106] The CRDF grant program reaches scientists in Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.[107] These eleven governments have memoranda of understanding with CRDF concerning cost-sharing arrangements and the terms of access to participating scientists, institutes, and pertinent equipment. CRDF grants are not taxed because this scientific grant program qualifies for tax-free status under laws governing humanitarian and scientific assistance. Former Soviet scientists receive 80 percent of the grant funds, with the remaining 20 percent going to U.S. scientific collaborators.[108]

---

[103] Science and Technology Center Ukraine, "Current Committed Project Funds. Internet: http: www.stcu.kiev.ua/html/project/tot_cont.htm. Downloaded 18 November 1999.

[104] The European Union contribution was 3 million Euros. Currency conversion was calculated based on the 18 November 1999 exchange rate of 1.04 U.S. dollars to the Euro.

[105] "Joint Statement: 8th STCU Governing Board Meeting" (Kiev: Science and Technology Center in Ukraine, 27 May 1999).

[106] The 1992 Freedom Support Act, Public Law 102–511, authorized the creation of the CRDF. *Program Report: 1995–1997*, U.S. Civilian Research and Development Foundation (Washington, D.C.: n.d.): 1.

[107] At the request of the U.S. government, CRDF suspended activities with Belarus in 1997. *1997 Annual Report on U.S. Government Assistance to and Cooperative Activities*, 137.

[108] Funds provided to U.S. scientists can only be used for travel and disposable supplies, not for salaries or overhead costs. U.S. scientists are encouraged to visit their counterparts to check on the progress of research. CRDF staffer, interview with the author, Washington, D.C., 18 November 1999. See also *1995–1997 CRDF Program Report*, 3; "1999–2000 Cooperative Grants Program: Application Form,"

One of CRDF's primary objectives is to "promote the transition of [former Soviet] research institutes, scientists, and engineers from defense-oriented activities to civilian research," so grant applications that include former weaponeers receive "special consideration" in ranking proposals.[109] With its hybrid scientific research and defense conversion mission, however, CRDF is neither a pure science nor a pure nonproliferation outfit. Perhaps for this reason, CRDF receives funds from multiple sources, including the Freedom Support Act, the Defense Department's Cooperative Threat Reduction program, the National Science Foundation, the National Oceanic and Atmospheric Administration, the National Institutes of Health, and the John D. and Catherine T. MacArthur Foundation.[110]

In award size and project length, the CRDF cooperative grants program is more modest than the ISTC's. The average size of a CRDF grant is $50,000, and the research efforts usually run over a period of a year to eighteen months. Over 3,000 applications were received for the 1996–1998 grant cycle and reviewed by six expert panels composed of roughly two hundred U.S. scientists. Proposals are evaluated first based upon their scientific caliber and prospects for results, including commercial potential. Extra points are added for those project teams that include weaponeers and young or female scientists. Some consideration is also given to selecting projects from each region. Reviewers are asked to screen out any proposals that might have defense relevance or that lack a plausible civilian application. Any proposals that involve weapons scientists are also subjected to an interagency review in the Nonproliferation Roundtable. After the CRDF selects the proposals it would like to fund, it approaches the science agencies in the respective

---

Civilian Research and Development Foundation (Washington, D.C.: 1999).

[109] The mission statement is taken from page four of the *1995-1997 CRDF Program Report*. Any weapons scientists from Kazakhstan or Russia who apply for a CRDF grant are required to obtain clearance from their government to participate in the grant program. Written authorization from the Ministry of Science must accompany the grant application. Approximately 1,000 scientists also provided written reviews of proposals. See CRDF "1999–2000 Cooperative Grants Program: Application Form."

[110] Funds from these various sources are channeled through the National Science Foundation to CRDF. In the fiscal 2000 budget, the State Department listed CRDF as a line item in its Freedom Support Act budget. The CRDF was born out of a $5 million challenge grant from George Soros via the National Science Foundation. The U.S. government provided $5 million in matching funds through the Cooperative Threat Reduction Act. Additional monies for CRDF activities have come through American industry, and cost-sharing contributions from former Soviet governments. *1995–1997 CRDF Program Report*, 1.

government to settle financial arrangements concerning how much the host government will contribute.[111]

To date, CRDF has issued funds in one cooperative grant cycle, although a second grant competition was initiated in 1999.[112] In September 1996, the CRDF awarded 281 grants worth $11.6 million. CRDF provided $9 million of that amount, and nine former Soviet governments contributed $2.4 million.[113] Of the proposals funded, 40 percent involved former defense scientists and engineers who agreed to abandon their defense work for the duration of their CRDF grant.[114]

The Initiatives for Proliferation Prevention Program

Another U.S. brain drain prevention program housed in the Department of Energy seeks to team U.S. national laboratory scientists with counterparts within the former Soviet weapons complexes. The impetus for the program was that the Energy Department's national laboratories were filled with scientists who would be fitting scientific collaborators. Since the end of the Cold War, the U.S. weapons laboratories have begun their own transition of sorts, placing renewed emphasis on research with medical, energy, and environmental clean-up applications and joining forces more frequently with commercial firms and universities.[115] Therefore, U.S. weapons scientists, who have also worked in a

---

[111] Mr. Charles T. Owens, Senior Vice President of CRDF, interview with the author, Washington, D.C., 17 November 1999.

[112] Awards for the 1999–2000 competition, which closed 1 October 1999, are expected to be made late in the summer of 2000. Ibid.

[113] Governmental agencies from Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Ukraine, and Uzbekistan shared the costs of these grants, and $200,000 came from other sources. *1996–1998 Cooperative Grants Program: Scientific Abstracts*, U.S. Civilian Research and Development Foundation (Washington, D.C.: n.d.), preface.

[114] *1995–1997 CRDF Program Report*, 4, 10, 46.

[115] In the mid–1980s, the national laboratories began partnering with U.S. commercial firms in Cooperative Research and Development Agreements, combining capital and intellectual resources for maximum research results. By 1999, over 1,500 such agreements had been penned to facilitate technology transfers from the government laboratories to the private sector. "The Role of The U.S. Department of Energy National Laboratories in The Initiatives for Proliferation Prevention Program," Office of Nonproliferation and National Security (Washington, D.C.: U.S. Department of Energy, July 1999), 8–9. For more on changes taking place at the U.S. laboratories, see *Alternative Futures for the Department of Energy Laboratories*, Task Force on Alternative Futures for the Department of Energy National Laboratories (Washington, D.C.: Department of Energy, February 1995).

closed defense research environment, would be good partners for the former Soviet weapons of mass destruction experts trying to orient their toward peaceful and commercial applications. U.S. weapons scientists would also be ideal research monitors, ensuring that the IPP-sponsored research does not have military applications. The effort, which began in 1994, is called Initiatives for Proliferation Prevention.[116]

As collaborators, the U.S. scientists are responsible for helping to initiate and refine research concepts with the weapons scientists in the former USSR. They make technical contributions to the research, manage and monitor the project, file required progress reports, and ensure that intellectual property rights are protected.[117] National laboratory scientists are also the mainstay of a multi-layered review process for prospective projects, during which about 50 percent of the proposals are substantially reworked or thrown out entirely. Projects are rated on their technical feasibility, nonproliferation benefits, and commercial prospects. These same scientists also review all of the proposals eventually funded by the ISTC and STCU, and additional inter-departmental coordination occurs when Energy Department officials vet their selected proposals through the interagency Nonproliferation Roundtable.[118]

By April 1997, the IPP program had over three hundred "lab-to-lab" projects underway to identify worthy research concepts and help the former Soviet weapons scientists develop technologies with viable peaceful applications.[119] As of July 1999, the IPP program had engaged over 6,200 nuclear, missile, biological, and chemical weapons

---

[116] The IPP program was formed pursuant to the 1994 Foreign Operations Appropriations Act, Public Law 103–87. Ten national laboratories take part in the IPP program. *1997 Annual Report on U.S. Government Assistance to and Cooperative Activities,* 144.

[117] "The Role of The U.S. Department of Energy National Laboratories," 10–1.

[118] First, a committee of scientists from the national laboratories reviews proposals for technical soundness, commercial potential, and the dual-use nature of the proposed research before passing them to the U.S. industry coalition for additional scrutiny of a project's commercial viability. Proposals that pass this preliminary review are then examined at Department of Energy headquarters and by the interagency and must pass a second review by laboratory experts, the interagency, and headquarters before a grant is approved. U.S. government official, interview with the author, Washington, D.C., 2 August 1999. See also, "The Role of The U.S. Department of Energy National Laboratories," 8.

[119] "Initiatives for Proliferation Prevention" (Washington, D.C.: U.S. Department of Energy, April 1997), 1.

scientists in collaborative research projects. The IPP program expended $39 million on grants at 205 weapons institutes in Belarus, Kazakhstan, Russia, and Ukraine.[120]

From 1994 to 1999, the U.S. government put $126.7 million into the IPP program. The Freedom Support Act was the funding vehicle in 1994, but from 1996 forward the IPP budget has been situated in the Energy and Water Appropriations Act.[121] IPP grants are implemented via the national laboratories on fixed-price contracts, an approach that has drawn considerable fire. In a harsh report, the U.S. General Accounting Office found that a low percentage of IPP funds—only 37 percent—was reaching former Soviet weapons scientists and that the remaining 63 percent was being spent on the participation of the national laboratory scientists or U.S. companies involved in IPP projects.[122] The Energy Department's explanation for this disparity lies in the relative state of the economies in the United States, Russia, and the USSR's former satellite countries. Whereas the charge for a U.S. national laboratory scientist, complete with overhead, averages $250,000 per year, the IPP budgets $5,400 to pay a former Soviet weaponeer.[123] Another problem in the IPP program is that a bilateral agreement providing for tax exemption in Russia has been sporadically enforced. Thus, IPP grant payments to former Soviet weaponeers have also been taxed, which further reduced the percentage of IPP funds reaching the target scientists.[124] In one IPP grant to Vector scientists, 40 percent of their IPP stipend, which

---

[120] The IPP grants went to 170 Russian institutes, 24 Ukrainian institutes, and 8 and 3 institutes in Kazakhstan and Belarus, respectively. "The Role of The U.S. Department of Energy National Laboratories,"1, 3.

[121] In 1994, the IPP program received $35 million under the Freedom Support Act. No government funds went to the program in 1995. In 1996, $10 million was set aside for the IPP program in the Energy and Water Appropriation Act, followed by $29.6 million in 1997 and 1998 and $22.5 million in 1999. Information provided to the author by the Initiatives for Proliferation Prevention Program Office, U.S. Department of Energy, 2 August 1999.

[122] In one case, Energy Department records showed that a Russian institute received $68,200 of a $99,700 project, but $27,000 actually went to the institute. Of that amount, $5,000 went to the principal Russian scientist whose invention was the reason for the project. The remainder of the $27,000 went for taxes and the institute's overhead. See *Concerns With DOE's Efforts to Reduce the Risks Posed by Russia's Unemployed Weapons Scientists*, GAO/RCED–99–54 (Washington, D.C.: General Accounting Office, February 1999), 3, 31–2.

[123] "The Role of the U.S. Department of Energy National Laboratories," 9.

[124] The agreement in question, the 1996 Panskov-Pickering Agreement, specifies deferral of customs duties and income, value-added, excise, and property taxes, but it provides uncertain assistance in this matter. Recipient scientists do not know to ask for the deferral and the Russia government has vacillated on honoring the agreement without Duma approval of a 1992 bilateral agreement exempting some taxes on U.S. aid. In addition to payroll taxes (e.g., pension, medical insurance, and a social security-type fund),

ranged from $15 to $25 per day, went to taxes.[125] The Department of Energy has taken steps, discussed in later in this report, to address these and other criticisms.

European Scientific Grant Programs

A final set of scientific grant programs, shown in Figure 3, is funded by European governments. In 1991, the European Union began an aid program under its External Relations office known as Technical Assistance to the Commonwealth of Independent States. The European Union's funding to the ISTC, which totaled $63.9 million from 1994 to 1998, falls under this technical assistance program. In 1999, the European Union dedicated another $17.5 million to the ISTC's research programs. Just over $3 million also went to the STCU through this program.[126]

The European Union also supports a general scientific grant fund, called Copernicus, through the European Commission's Research Directorate. Since its creation in 1992, Copernicus has supported scientists through joint research projects, fellowships, and travel aid to attend conferences. In 1998, the European Union restructured the entire European research and development program to revolve around broad quality-of-life themes, including the management of living sources, a user-friendly information society, competitive

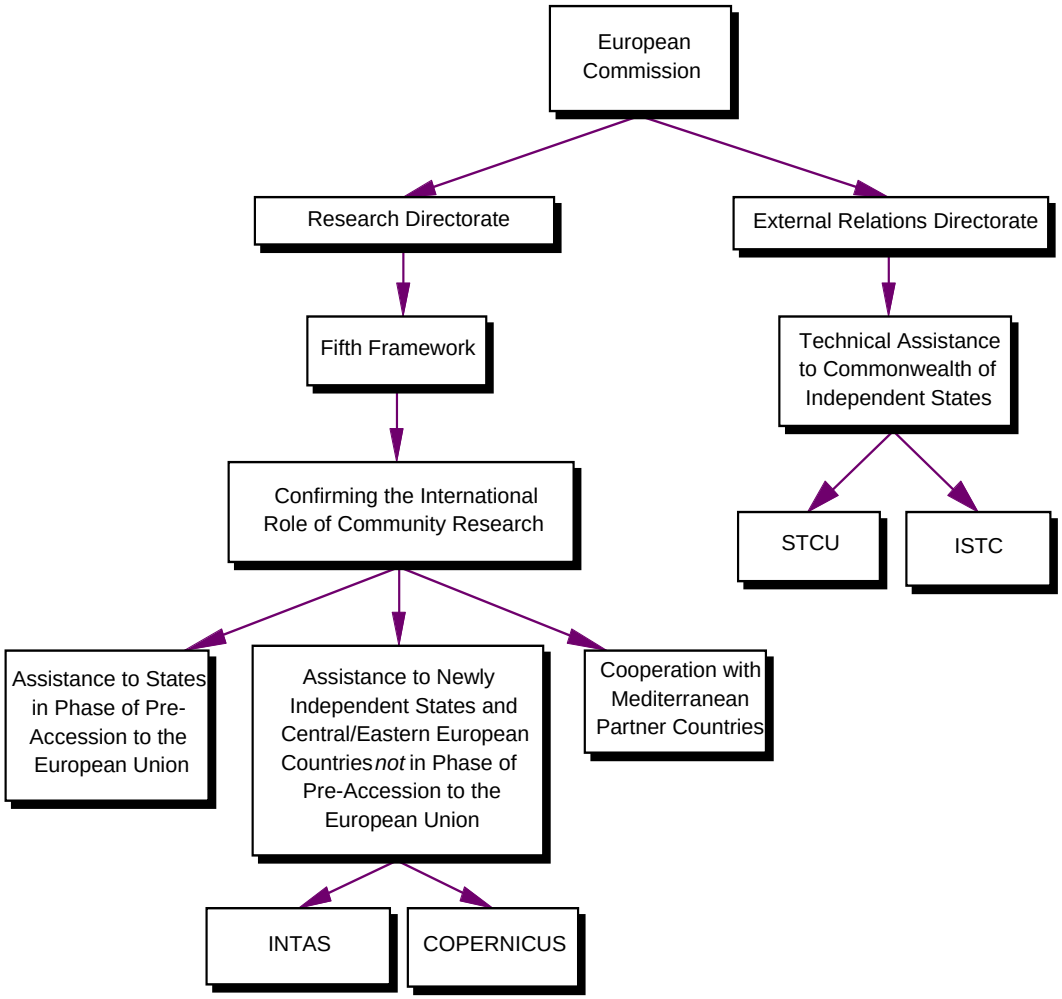
---

scientists may have an income tax of 12 to 35 percent subtracted from their salaries. General Accounting Office, *Concerns With DOE's Efforts to Reduce the Risks*, 31, 33.

[125] The scientists involved have Ph.D. degrees or are technicians. Ibid., 84.

[126] European Report, "TACIS Funding for Scientific Projects in Russia and Ukraine," No. 2428 (28 July 1999).

Figure 3: Organization of European Union Grant Assistance to the Former Soviet Union.



and sustainable growth, and energy, environment, and sustainable development. International cooperation, however, continues to be a key element of that agenda. The Copernicus program, which will offer some $29 million in 1999, still awards grants to scientists in Russia and other former Soviet states.[127]

The European Union also supports another research grant organization called INTAS under the rubric of its research directorate. In 1993, the European Union formed the independent association INTAS, which stands for the International Association for the

[127] "Work Programme in the Framework of the Specific Programme for Research, Technological Development and Demonstration on Confirming the International Role of Community Research," (Brussels: European Commission, 24 February 1999).

Promotion of Cooperation with Scientists from the Independent States of the Former Soviet Union. The INTAS mandate is to provide scientists in the former Soviet Union with opportunities to engage in collaborative peaceful research with European partners, obviously much broader than nonproliferation alone. Programming areas include chemistry, life sciences, physics, engineering, and space sciences.[128]

INTAS somewhat parallels the CRDF in the United States. Being a weapons expert is not a prerequisite for applying for an INTAS or CRDF grant. However, CRDF gives weaponeers special priority in the grant selection process and INTAS does not. Nonetheless, former weapons scientists have certainly been INTAS grant recipients. During its first five years, INTAS funded more than 1,500 projects worth $87 million that reached some 17,000 former Soviet scientists. For the 1999–2002 time frame, the European Union set aside nearly $73 million for INTAS, or 95 percent of the organization's budget.[129]

Audit Angst

Grant programs to enlist former Soviet weapons of mass destruction experts in collaborative research have not been without their critics. The main concern appears to be the lack of guarantees that scientists receiving grant support may not have completely stopped offensive weapons activities.[130] Another concern is that the institutes might somehow drain grant monies to continue offensive research that the government would otherwise not be able to afford. Critics also assert that some grants may be paying for research that has already been done, a problem that many grant-givers face, inside and outside of the U.S. government.

---

[128] International Association for the Promotion of Cooperation with Scientists from the Independent States of the Former Soviet Union. Internet: http://www.intas.be/mainfs.htm. Downloaded 18 November 1999.

[129] "Work Programme in the Framework of the Specific Programme for Research, Technological Development and Demonstration on Confirming the International Role of Community Research," (Brussels: European Commission, 24 February 1999); "Democracy and Investment New Focus of EU Assistance to Russia, Ukraine and Other New Independent States," Press Release IP–98/1159 (Brussels: European Commission, 22 December 1998).

[130] This criticism was raised, for instance, by the General Accounting Office in *Weapons of Mass Destruction: Reducing the Threat From the Former Soviet Union: An Update*, NSIAD–95–165 (Washington, D.C.: U.S. Congress, General Accounting Office, 9 June 1995): 28.

The possibility that scientists receiving grant aid would moonlight is something that no scientific grant program can preclude. Scientists could work for proliferators in their off hours, a time period over which the grant organizations cannot assert firm control. The ISTC and other grant programs can only monitor time spent on the job. In that regard, the behavior pattern observed during work hours should be somewhat reassuring for those worried about moonlighters. The scientists receiving ISTC grants appear to be spending more time working on their grant projects than their budgets allow.[131] Whether this trend arises from boredom, desire to impress scientific collaborators, instructions from the institute director, or some other factor is not known. For whatever reason, grant recipients appear dedicated to their collaborative research.

Another factor to bear in mind is that Russia's encounter with domestic terrorism in 1999 has underscored for some scientists the importance of keeping their secrets to themselves.[132] "Especially now that we understand what terrorism really is," stated the deputy director of a biological weapons institute, "we will be even more careful."[133] The director of another biological institute expressed similar views: "Now, we have common enemies, bioterrorism and countries with nonpredictive regimes. It is very important to find ways to collaborate."[134] If there is a silver lining to come out of the deadly terrorist attacks in Moscow, it may be that the communities of chemical and biological weapons experts have a renewed sense of the importance of policing their own actions.

As for the concern that grant money could be shifted to offensive work, no organization can absolutely certify that such diversion is not taking place. However, the

---

[131] Senior ISTC staff member, interview with the author, Moscow, 21 September 1999; senior ISTC staff member, 16 September 1999 interview with the author.

[132] The September 1999 series of apartment bombings in Moscow, Volgodonsk and Dagestan killed some 280 people in less than three weeks. See Michael R. Gordon, "Russians Name a Chechen as the Chief Suspect in 5 Bombings," *New York Times,* 18 September 1999, A3; David Hoffman, "Fourth Blast In Russia Kills 17," *Washington Post,* 17 September 1999, A17.

[133] Biological institute deputy director, 17 September 1999 interview with the author.

[134] Biological institute general director, 17 September 1999 interview with the author. On several occasions, scientists have used the phrase "common enemy" when the topic of terrorism has been raised. Senior ISTC staff member, 21 September 1999 interview with the author.

ISTC has established a series of safeguards to deter and detect the abuse of ISTC funds.[135] First, the ISTC requires the director of each institute in the ISTC grant program to sign a legal document certifying that the scientists are not getting paid by another organization to do the same work. Next, the ISTC requires each scientist working on the project to establish a separate bank account solely for ISTC deposits. Every quarter, the ISTC sends payments to the individual scientists. In addition, operational rules require that all major equipment purchases necessary for project work are made through the ISTC. A maximum of 10 percent of a project's expenses can be directed to institutional overhead costs, and the U.S. government often insists on a smaller overhead percentage. Finally, every project manager must bring financial records to the ISTC every quarter and reconcile these records with the ISTC's auditing staff before any payments for the next quarter are made.[136] In other words, the ISTC has its scientists on a very short financial leash.

Any diversion of funds attempted under these arrangements would have to be very elaborate. To amass a meaningful amount of cash, literally all of the scientists at an institute would have to relinquish their ISTC salaries. The ISTC takes further precautions against misuse of funds by augmenting its quarterly financial audits with periodic technical monitoring trips to the institutes.[137] During a technical monitoring visit, the ISTC staffers interview the scientists working on a project and inspect the equipment purchased for the project to ensure that it is being used as agreed. Early on, an institute refused access to the areas where project equipment was located, but was compelled to cooperate after the ISTC halted project payments. As a warning, the ISTC circulated word of this incident and the ISTC's handling of it.[138]

---

[135] Until the ISTC was able to establish its own auditing capability, ISTC grants were audited by the Defense Contract Auditing Agency, which is under contract to the State Department to scrutinize ISTC activities for reporting to Congress. This defense agency audited the ISTC's grants for the first two years of the ISTC's operation and continues to do so. The European Union also sends in separate auditors. Senior ISTC staff member, 21 September 1999 interview with the author.

[136] Overhead includes project-associated costs such as security, hot water, electricity, and phone bills. The ISTC expends an average of $40 million in major equipment purchases for the projects. The institute hosting a project is required to set up an ISTC-only bank account for the smaller procurement purchases. Senior ISTC staff members, 20 and 21 September 1999 interviews with the author.

[137] *1997 Annual Report on U.S. Government Assistance to and Cooperative Activities,* 135; Alessi and Lehman, "Science in Pursuit of Peace," 20.

[138] Senior ISTC staff members, 16 and 21 September 1999 interviews with the author.

The ISTC has a final series of auditing sticks to encourage good behavior. The ISTC takes note of any project manager who fails to open the requisite bank account promptly or does a poor job of record-keeping. If that individual is again awarded an ISTC grant, the ISTC can conduct a special on-site audit at the outset of the new grant to emphasize proper technical and financial behavior for ISTC grantees. Any scientists that flout the rules will find their grant payments suspended until they accept ISTC practice or they forfeit the grant. Next, the ISTC conducts close-out audits. The ISTC does not release overhead costs to a project manager until its auditors go on-site to close the books.[139] Finally, the ISTC has the right to return for an additional audit up to five years after the closure of a project.[140]

Grant monitoring is a daily responsibility at the ISTC. In 1997 and 1998, the ISTC completed over two hundred technical monitoring trips to weapons institutes. Over 120 projects were audited financially in each of these years.[141] The ISTC's fiscal and technical auditors have come across a few small problems, but none of any significance.[142] However, should signs be detected that an institute director was skimming funds for covert weapons work or personal gain, the ISTC would sever grant payments, investigate thoroughly, punish the offender(s) appropriately, and make this episode a well-known example of the consequences of breaking the rules.[143]

---

[139] As noted, overhead costs cannot exceed 10 percent but cannot be less than 2 percent of the total project costs so that the ISTC retains some leverage with project managers. Overhead costs average 5 to 7 percent. Senior ISTC staff members, 16 and 21 September 1999 interviews with the author.

[140] Only one such post-closure audit has been conducted. The Defense Contract Auditing Agency audited one project two years after its books were closed. Senior ISTC staff member, 21 September 1999 interview with the author.

[141] *1997 Annual Report on U.S. Government Assistance to and Cooperative Activities*, 135; *1998 ISTC Annual Report*, 6.

[142] "We don't come across serious problems," observed a senior ISTC staffer, perhaps because the scientists carry with them a fear of the consequences of Soviet-era audits. The most contentious encounter to date occurred between a Defense Contract Auditing Agency official and a biologist, who reportedly said that he did not respect Americans during the Cold War, did not respect Americans now, and never would respect Americans. The minor problems encountered center around scientists who are unaccustomed to managing their own funds and tend to defer decisions to their institute directors or do a poor job of maintaining their own books and keeping receipts. Senior ISTC staff member, 21 September 1999 interview with the author. Other problems uncovered were the payment of people not working on a project, such as the cleaning staff. All such problems have been corrected. Senior ISTC staff members, 16 and 21 September 1999 interviews with the author.

[143] Senior ISTC staff member, 21 September 1999 interview with the author.

CRDF has established procedures to track its grants that resemble some of the ISTC's practices. First, CRDF formally audits the banks that provide financial services for CRDF grants and also conducts unannounced site visits to the banks to check transactions. Payment to participating scientists is made on a quarterly basis into bank accounts for that purpose. Participating scientists are required to file a quarterly progress report, which their U.S. scientific collaborator co-signs. CRDF rectifies financial records for each project before issuing subsequent payments. Should a situation merit the curtailment of funding, the U.S. collaborator would notify CRDF. CRDF also monitors the progress of grant research when its staff members or the collaborating U.S. scientists visit the institutes, at which time they have access to the scientists and any equipment that might have been purchased with grant funds. Every year, up to 20 percent of the institutes in the CRDF grant program receive a random site visit. CRDF may also dispatch an expert team to review the progress of a larger grant. Such expert reviews have been conducted at Obolensk and Vector.[144]

Of the three grant programs, the IPP program has the weakest methods for checking that its grant funds are spent appropriately.[145] Operating without a government-to-government agreement guaranteeing access to project records and facilities, the IPP program is unable to audit the books of its project scientists. The IPP program has established a ceiling of 10 percent of the grant amount for institutional overhead costs. After U.S. national laboratory collaborators see scientific deliverables or products at various stages of a research project, they authorize payment into a bank account that the participating institutes designates. This results-before-payment arrangement sometimes causes significant delays in getting wages to the scientists and does not provide a firm way of ascertaining how much money went to the scientists' salaries as opposed to the institute's expenses, bank fees,

---

[144] Banks are audited every year. CRDF has over fifteen staffers in Moscow, Kiev, and St. Petersburg to assist with grant programs and address any problems that might arise. Payments for overhead costs average 10 percent of the grant award and are sent to the participating institutes on a quarterly basis as well. CRDF maintains a list of scientists who fail to meet quarterly or final reporting requirements, and applications from such individuals will be rejected in future grant competitions. Mr. Charles Owens, 17 November 1999 interview with the author; CRDF staffer, 18 November 1999 interview with the author. With the exception of major equipment purchases for six Regional Experimental Support Centers, the purchase of expensive equipment is infrequent in the CRDF grant program. Spectrometers, x-ray diffraction equipment, and a scanning probe microscope were among the items purchased and installed in this $1.15 million CRDF program. *1995–1997 CRDF Program Report*, 36–7.

[145] U.S. government official, 2 August 1999 interview with the author.

taxes, or other purposes.[146] In the fall of 1999, the Energy Department was exploring the possibility of channeling IPP grant payments through the CRDF, which would exempt the IPP grants from taxes and provide some additional auditing assurance.[147]

Given the extreme secrecy that enveloped the biological and chemical complexes, it is difficult for the ISTC's funders to discern whether a proposed research project was undertaken previously and the results are already on the shelf.[148] Two prominent whistle-blowers from the Soviet chemical and biological programs, Mirzayanov and Alibek, very strongly believe that some scientists have attempted to dupe the grant programs by proposing research projects that replicate prior work.[149] U.S. officials say they recognize this possibility and that there may be good reasons for doing so in some cases. First, it may be beneficial to pay for classified research to be performed again at the unclassified level to enable outside experts to examine the work and so that the results can enter the public

---

[146] "Neither the [Energy Department] nor its laboratories require any receipts or other explanation from the Russian institutes to show how the funds sent to Russia are allocated. Financial officials and others at the [Energy Department] laboratories are satisfied if they have documentation that the funds went to the designated back account for the [former Soviet] institute." General Accounting Office, *Concerns With DOE's Efforts to Reduce the Risks*, 30.

[147] U.S. government official, 2 August 1999 interview with the author; CRDF staffer, 18 November 1999 interview with the author.

[148] Rarely during the Soviet era were weapons scientists allowed to publish their research results, but the U.S. experts who review the proposals are familiar with the state of the art in science and many have interacted with their contemporaries within the chemical and biological complexes.

[149] "The ISTC is funding research that has already been done in Biopreparat and research that is not scientifically advanced." In 1995, Alibek saw a full list of the proposals submitted by Biopreparat scientists, about 50 percent of which involved research that was partially or completely already done. Alibek has additional concerns that the managers of Biopreparat's institutes are skimming money off of the grants because they insist that their scientists employ them as consultants. Profiteering from these grants, he suspects, is widespread. Dr. Ken Alibek, interview with the author, 6 May 1999. Dr. Mirzayanov echoed those sentiments in a 28 April 1999 interview with the author:

> The price of labor and materials is very difficult to know with certainty since these facilities are in part still operating in a controlled-economy mode. A scientist who submits a proposal to the ISTC for $5,000 of basic research and can be bluntly told by his superiors that $4,000 of those funds will be siphoned for other purposes. In the best case, the money would be stolen for the personal profit of those who control GosNIIOKhT. In the worst, the funds would be spent to support research on new poison agents, such as those that can penetrate the filters of gas masks. GosNIIOKhT's scientists already have the ideas—all they need is the money for the research. When the ISTC's accountants check on a project, both the proposed basic research and the secret military project will have been done, but the official books will show only the peaceful research.

domain. Second, redoing research requires weapons scientists to document an experiment's standards and protocols. Finally, the ISTC's funders have provided grants to validate in the laboratory some of the more dubious claims occasionally made by the weapons experts about a product or a capability.[150]

Formal financial audits and technical monitoring aside, another significant source of information about what is happening at the weapons institutes comes from the officials, advisers, and delegations that frequently and informally visit these institutes to check on the progress of the research projects. These individuals provide yet another check against foul play with grant funds. Several institutes have put out the welcome mat, and the traffic through them can be considerable. "Vector," according to one ISTC staffer, "does not have a day without guests."[151] Maintaining covert chemical or biological weapons research and production amid such scrutiny would require considerable effort and artifice. Nonetheless, an atmosphere of mistrust still clouds collaborative efforts with the chemical and biological institutes because access is still denied to some facilities and is sporadic at others.

---

[150] U.S. government officials, 19 and 24 May 1999 interviews with the author.

[151] Interview with the author, 15 September 1999. While conducting interviews for this report, the author visited two institutes and received invitations from five others to visit their facilities. In the spring of 1999, for example, three teams of Defense Department veterinarians went to biological institutes to assess their laboratory animal practices. U.S. government officials, 19 and 24 May 1999 interviews with the author.

THE EARLY TRACK RECORD

Assessing the effectiveness of the brain drain prevention efforts is complicated by the fact that even in the late 1990s, there was still no such thing as a definitive list of key chemical and biological weapons specialists that should be brought into these grant programs. Public sources provide rough estimates of how many weapons specialists populated the chemical and biological programs, but the accuracy of those numbers is difficult to confirm and these tallies do not often distinguish between key scientists, technicians, and other support personnel. One U.S. official concedes that trying to figure out just how many scientists in the chemical area should be targeted for grant assistance has been "one of the hardest things to estimate."[152] Other U.S. officials note that as they have interacted with the biological weaponeers, on several occasions they have uncovered entire institutes that were not previously known to be part of the biological weapons complex.[153] Although the exact figure remains elusive, the U.S. government estimates that roughly 10,500 former Soviet chemical and biological weaponeers are of high-risk proliferation concern, including 3,500 chemical weapons scientists and 7,000 biological weapons scientists.[154] For comparative purposes, the number of former Soviet nuclear weapons scientists categorized as being of critical proliferation concern is 2,000.[155]

At the ISTC's headquarters in Moscow, there is confidence that they have made headway with these target populations. The ISTC estimates unofficially that there are thirteen to fifteen core biological weapons institutes, of which the ISTC has established a relationship with all but two. "Once we get to these core facilities, I feel like the ISTC will have accomplished the goal of reaching the key intellectual and biological talent behind the weapons program," stated a senior ISTC staff member.[156] The ISTC is working about five

---

[152] U.S. government official, 19 May 1999 interview with the author.

[153] U.S. government officials, 24 May and 2 August 1999 interviews with the author.

[154] According to U.S. government officials, the actual number of biological and chemical weapons scientists is much higher, but the 10,500 figure is a working estimate of those with critical knowledge. Of the 7,000 biological experts, 6,500 are in Russia and another 500 in the former Soviet satellite states. Interviews with the author, 19 May and 4 October 1999.

[155] The former Soviet nuclear weapons community is estimated at 50,000 to 60,000. The scientists deemed critical are those with comprehensive knowledge of all aspects of a nuclear weapons system or those with extensive, in-depth skills in weapons design, fabrication, or some other esoteric aspect of nuclear weaponry. U.S. government official, 17 May 1999 interview with the author.

[156] This individual further observed that the ISTC is not meant to give grant assistance to everyone with a biology degree. Comments made in a 20 September 1999 interview with the author.

of the ten chemical sites it places in this core proliferation-risk category, specifically the facilities that crafted missile warheads for poison gas as well as the GosNIIOKhT branches in Moscow, Shikhany, Novocheboksarsk, and Volgograd.[126] Particularly with regard to the chemical complex, some dimensions of which are not well understood, it is difficult for the ISTC to know whether its grants are reaching all of the key weapons institutes. This situation is complicated by the prerogative of host governments to turn back proposals before they reach the ISTC. "If domestic authorities decide an applying institute should remain secret and closed, the ISTC has no way of knowing" of their involvement in the weapons program.[127] In short, the ISTC cannot force its way into institutes; grants can only proceed when host governments acquiesce and aid the effort.

Given these circumstances, at first the chemical grants concentrated almost exclusively at GosNIIOKhT in Moscow, while biological projects were centered at Vector and Obolensk. In the last two years, however, a more lengthy list of chemical and biological institutes, some of which are named in Table 3, have received grant support from the ISTC, as well as from the STCU. By 1999, the ISTC had at least thirty chemical and fifty-four biological institutes in Armenia, Belarus, Georgia, Kazakhstan, Russia, and Uzbekistan involved in the grant program.[128]

The influx of ISTC funds has enabled institutes to pay their remaining staffs more regularly and to run experiments on equipment that would otherwise be idle.[129] In some cases, ISTC funding has made a visible impact on the institutes. For example, the Moscow branch of GosNIIOKhT has been working with the ISTC since 1994, gaining ISTC board approval for twelve projects valued at $3,656,000. Some 650 scientists, mostly from GosNIIOKhT but also from other premier chemical institutes, have participated in these

---

[126] Ibid.

[127] ISTC staff member, 17 September 1999 interview with the author.

[128] Data provided to the author by the International Science and Technology Center on 14 October 1999.

[129] Senior chemist, 15 September 1999 interview with the author; senior biological researcher, 17 September 1999 interview with the author.

Table 3: Selected Institutes in the Former Soviet Chemical and Biological Complexes Receiving Grant Support.

Chemical Institutes	Biological Institutes
Institute of Chemical Physics *St. Petersburg, Russia*	Ivanovsky Institute of Virology *Moscow, Russia*
Institute of Fine Organic Chemistry *Yerevan, Armenia*	Armenian Institute of Applied Chemistry *Yerevan, Armenia*
Institute of Chemistry and Chemical Technology *Bishkek, Kyrgyzstan*	Institute of Epidemiology and Infectious Disease *Kiev, Ukraine*
Institute of Artificial Fibers and Pilot Plant *Kiev, Ukraine*	National Biotechnology Center of Kazakhstan *Almaty, Kazakhstan*
Institute of Common and Non-Organic Chemistry *Minsk, Belarus*	Lviv Research Institute of Epidemiology and Hygiene *Lviv, Ukraine*
Central Scientific Research Institute of Special Machine Building *Kalingrad, Russia*	Institute of Biochemistry and Physiology of Microorganisms *Moscow region, Russia*

twelve ISTC grants.[130] For three laboratories at the Institute of Highly Pure Biopreparations in St. Petersburg, ISTC grants are the most important source of support, paying for 60 to 70 percent of the scientists' salaries.[131] In 1999, Obolensk was receiving roughly as much financial support from the ISTC as from the Russian government. Apparently all of the dangerous pathogens scientists remaining at Obolensk are working under ISTC grants, and at any time nearly 50 percent of the Obolensk staff owes much of their livelihood to ISTC grants.[132]

Moreover, the ISTC's grants are apparently the main lifeline for the Ivanovsky Institute of Virology, which houses an excellent virus collection. The Central Institute of Epidemiology, which has a huge epidemiological database, and the Institute of Experimental

[130] Senior chemist, 15 September 1999 interview with the author. ISTC grants were described as "very essential assistance" to GosNIIOKhT, which was "able to busy former chemical weapons specialists with very important work." Chemical institute director, 15 September 1999 interview with the author.

[131] Head of biochemistry laboratory, 17 September 1999 interview with the author.

[132] Those on ISTC grants spend 40 to 50 percent of their time working on ISTC-sponsored research and the rest on projects for the Ministry of Science and Technology. Senior biologist, 16 September 1999 interview with the author.

Veterinary Medicine also depend completely on ISTC funds. "Otherwise, these institutes would disappear."[133] Even Moscow-area institutes, which are generally perceived to be in better fiscal shape than those located farther away from the capital, have been quite dependent upon ISTC funds to restore stability and meet staff payrolls. Inside the ISTC, however, the general pattern recognized is that the further away from Moscow the institutes are located, the more dependent they tend to be on the ISTC as their sole source of support aside from small government funds.[134]

Pieshares

Although it may be premature to draw definitive conclusions about the effectiveness of brain drain prevention programming, it is possible to examine the way in which resources are being disbursed and identify some noteworthy trends. In comparison to the support provided to nuclear specialists, Table 4 shows that the percentage of ISTC projects involving chemical and biological scientists was modest. The fraction of ISTC grants that went to chemistry projects hovered around 3 percent from 1994 to 1998, only approaching 4 percent in 1999.[135] Over the 1994 to 1998 time period, just over 13 percent of ISTC grants were in the field of biology. Even these higher levels of activity with biotechnology grants are less than half of projects that the ISTC sponsored in the nuclear technology areas. The ISTC gave at least ten times as many grants to nuclear weaponeers as it did to chemical weapons scientists.

While some chemical and biological weaponeers may have received ISTC funding under other technology areas (e.g., environment, materials science, other basic sciences and technology), it is fair to say that funding for these weapons scientists still lagged far behind nuclear weapons specialists. From 1994 to 1998, the ISTC delivered $5.9 million to

---

[133] European and Japanese companies have reportedly approached the Ivanovsky Institute with offers to purchase their virus collection. ISTC staff member, 20 September 1999 interview with the author.

[134] Senior ISTC staff member, 21 September 1999 interview with the author.

[135] *International Science and Technology Center 1996 Annual Report* (Moscow: International Science and Technology Center, 1997), 6; *International Science and Technology Center 1997 Annual Report* (Moscow: International Science and Technology Center, 1998), 6; *1998 ISTC Annual Report*, 7. Data for 1994, 1995, and 1999 provided to the author by the International Science and Technology Center, 17 November 1999.

Table 4: ISTC Investment in Various Types of Projects (1994–1998).* SEE UPDATED STATISTICS p. 102

Technology Area	Number of Projects	Funding	Percentage of ISTC Projects	Percentage of ISTC Funding
Biotechnology and Life Sciences	88	$18.5 million	13.4%	9.8%
Chemistry	23	$5.9 million	3.6%	3.1%
Environment	131	$44.8 million	20.0%	23.6%
Information and Communications	25	$6.7 million	3.8%	3.5%
Instrumentation	48	$15.5 million	7.3%	8.2%
Manufacturing Technology	12	$1.8 million	1.8%	1.0%
Materials	66	$19.7 million	10.1%	10.4%
Fission Reactors, Fusion, Physics	204	$60.7 million	31.1%	32.0%
Non-Nuclear Energy	12	$3.9 million	1.8%	2.1%
Other	5	$0.4 million	0.8%	0.2%
Space, Aircraft, and Surface Transportation	41	$11.7 million	6.3%	6.2%
Total	656	$189.6 million	100.0%	100.0%

*These figures include projects that have been approved by the Governing Board but have not yet concluded a final project agreement; projects that are currently underway; and projects that have already been completed.
Source: *International Science and Technology Center 1998 Annual Report.*

chemistry projects, $18.5 million to biotechnology and the life sciences projects, and $60.7 million to projects revolving around fission reactors, fusion, and physics.

A check of the STCU database showed that by 1998 the STCU had received some 142 proposals for research in the disciplines of chemistry and biology. From those proposals, the STCU's Governing Board approved funding for seven chemistry and eight biology projects. The STCU awarded 215 grants, so 3.7 percent were in the field of biology and 3.3 percent were in chemistry.[136] Through 1998, the STCU expended about $1 million,

[136] These percentages derive from a thorough search of the STCU's on-line project database, which covers projects though 1998. Science and Technology Center Ukraine. Internet: http: www.stcu.kiev.ua. Downloaded on 19 November 1999.

or 3.7 percent, of its total $27 million budget on biological grants. The STCU's chemistry spending was approximately $880,000, or 3.3 percent of the entire grants budget.[137]

At CRDF,16 percent of the projects in the 1996 cooperative grants cycle were in biological and biomedical sciences and engineering, while 14 percent were in chemical sciences and engineering.[138] A smaller number of the grants in these disciplinary areas actually involved weapons scientists. Biological weaponeers were participants on five grant award teams located in Georgia, Russia, and Ukraine. Chemical weapons experts on eleven grant teams in Belarus, Georgia, Russia, and Ukraine received CRDF grants.[139] From CRDF's 1996 cooperative grants cycle, valued at $11.6 million, biological weapons scientists received approximately $250,000 in grants, or 2.2 percent of the cycle budget. CRDF sponsored about $550,000 worth of grants involving chemical weaponeers, or 4.7 percent of the total budget.[140]

Another CRDF grant program, entitled Collaborations in Biomedical and Behavioral Sciences, has particular bearing upon the institutes of the former Soviet biological weapons complex. In 1996, the National Institutes of Health asked CRDF to fund joint research activities in the biomedical area. From 350 proposals, CRDF awarded forty-three grants valued at just under $2 million to scientists in Georgia, Kazakhstan, Russia, and Ukraine. Research with infectious diseases comprised 23 percent of this category of grants, and eleven weapons experts were participating in this research. In 1998, CRDF also dispensed

---

[137] These estimates, calculated from an average cost per STCU project of $125,500, were confirmed on 24 November 1999 by the Office of Proliferation Threat Reduction, Bureau of Nonproliferation, U.S. Department of State.

[138] CRDF funded one biological and two chemical projects in Belarus, two biological projects in Georgia, three biological projects in Kazakhstan, one biological project in Kyrgyzstan, twenty-five biological and thirty chemical projects in Russia, and twelve biological and seven chemical projects in Ukraine. The CRDF also funded projects in Armenia, Moldova, and Uzbekistan, but none in the chemical and biological disciplines during the 1996 grant cycle. *1995–1997 CRDF Program Report*, 4, 10, 11, 46.

[139] Ibid., 12–30.

[140] The average CRDF grant award was $50,000. Thirty-four grants were made to biologists and thirty-nine to chemists.

an additional $210,000 in peaceful research grants to scientists affiliated with the biological weapons research and production facilities in Stepnogorsk, Kazakhstan.[141]

Like the ISTC and CRDF programs, the IPP program focused largely on the nuclear weapons community in Belarus, Kazakhstan, Russia, and Ukraine in its nascent years. In fact, the Nuclear Cities Initiative, which set out to integrate ten of Russia's closed nuclear cities into the civilian economy, became the best known segment of the IPP program.[142] In 1996, however, the State and Defense Departments asked the Energy Department to increase its programming in the biological and chemical fields, transferring $10 million in Cooperative Threat Reduction funds to the Energy Department that year for that purpose.[143] Consequently, the IPP program started to place more emphasis on working with biological weapons institutes. By the end of 1998, the IPP program had twenty-nine grants with biological weaponeers and twenty grants with chemical weapons scientists at various stages of development. Of a total of 413 IPP projects that were completed, underway, or approved at that time, 7 percent involved biologists and 4.8 percent chemists. From the $81.9 million in funds allocated to specific projects, the IPP program obligated roughly $6 million for approved research projects with biological weapons scientists. The corollary figure for chemical weapons experts was $4 million.[144] Ten U.S. national laboratories anchor the IPP program. For example, Pacific Northwest National Laboratory was running four projects with the National Center of Biotechnology in Kazakhstan, which is operated by specialists

---

[141] Proposal development activities involved twenty small grants for workshops and travel. The National Institutes of Health provided $1.3 million for this program, the government of Ukraine $100,000, and CRDF $550,000. The State Department funded the grants targeted at Stepnogorsk. *1995–1997 CRDF Program Report*, 31.

[142] The IPP program was working with Sarov (Arzamas-16), Snezhinsk (Chelyabinsk-70), Ozersk (Chelyabinsk-65), Seversk (Mayak), and Zhaleznogorsk (Krasnoyarsk-26). "Initiatives for Proliferation Prevention," 2. However, following the General Accounting Office's scathing review of the IPP program, Congress slashed its budget. For fiscal year 2000, the Department of Energy requested $30 million for the Nuclear Cities Initiative, but Congress approved only $7.5 million. See Title III, House Committee on Appropriations *Conference Report to Accompany H.R. 2605*, Public Law 106–60 (Washington, D.C.: U.S. House of Representatives, 27 September 1999), 100. See also, General Accounting Office, *Concerns With DOE's Efforts to Reduce the Risks*.

[143] Apparently, $1 million of that amount was earmarked for work with the large Khimprom chemical production facility at Volgograd and $1.5 million for programming with the Stepnogorsk biological production facility in Kazakhstan. U.S. government official, 2 August 1999 interview with the author.

[144] Note that contracts may still be negotiated with the institute in question after the IPP program obligates funds for a project. Information provided to the author by the Initiatives for Proliferation Prevention Program Office, U.S. Department of Energy, 12 October 1999.

who formerly worked at Stepnogorsk.[145] Pacific Northwest was also working with Vector to develop a diagnostic tool for liver fluke infection in humans and a new generation of agricultural pest control agents using baculoviruses.[146]

Chart 1 depicts the first obvious trend, namely the comparatively low number of chemical and biological projects as a percentage of overall program activity at the ISTC, STCU, IPP, and CRDF. This data is presented with the caveat that chemical and biological weapons scientists may have received funds in other grant categories, such as environment, materials science, or basic science. Out of a total 1,733 projects across all four grant programs, 178 were in biology and sixty-nine in chemistry. This trend can be further illustrated by isolating a couple of examples. In 1995, over 63 percent of the scientists receiving ISTC grants were nuclear weapons experts, 16 percent were missile delivery specialists, 4 percent were bioweaponeers, and 3 percent were chemical weapons experts.[147] Some 93 percent of the STCU's projects were in areas other than chemistry and biology.

As one might expect given the relatively small number of projects in the chemical and biological areas, the funding pattern matches. Chart 2 compares spending on chemistry and biology grants as opposed to all other grant areas. From 1994 to 1998, chemists received roughly $11.3 million in grants from the ISTC, STCU, IPP, and CRDF. Biological weapons experts fared better, receiving $25.75 million out of the total $310 million expended for brain drain prevention grants. As with the project percentage comparison, the same admonition applies: Chemical and biological weaponeers may have received funds in other grant categories. Even if chemists and biologists had received several million dollars

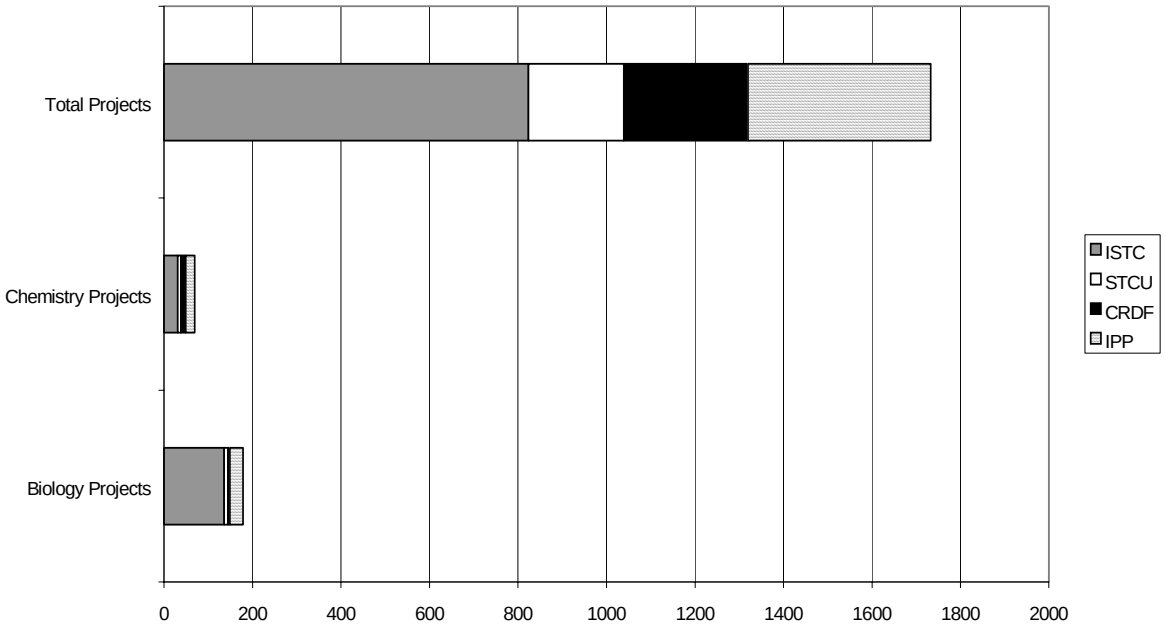
---

[145] U.S. government official, 2 August 1999 interview with the author.

[146] The first project is attempting to improve upon current technology by creating a blood assay to detect these liver fluke parasites. Working from Vector's vast baculovirus collection, DuPont has joined the effort to evaluate the suitability of viral, fungal, and bacterial pathogens that could thwart insect damage to plant crops. This biocontrol approach, which involves such efforts as re-engineering plants to make them resistant to insects, has a potential market estimated at $100 to $200 annually. "Initiatives for Proliferation Prevention," 12; "The Role of The U.S. Department of Energy National Laboratories," 20–1.

[147] *International Science and Technology Center: Second Annual Report* (Moscow: December 1995): 6. The ISTC's 1994 grant cycle reveals similar statistics. The ISTC states that when broken down by person-months, 67 percent of its funding went to nuclear weapons experts, 10 percent to missile delivery specialists, and 4 percent apiece to chemical and biological weapons experts. *International Science and Technology Center: First Annual Report* (Moscow: December 1994): 6.

Chart 1: Comparison of Chemistry and Biology Projects With Other Technology Areas (1994–1998).



	Biology Projects	Chemistry Projects	Total Projects
IPP	29	20	413
CRDF	5	11	281
STCU	8	7	215
ISTC	136	31	824

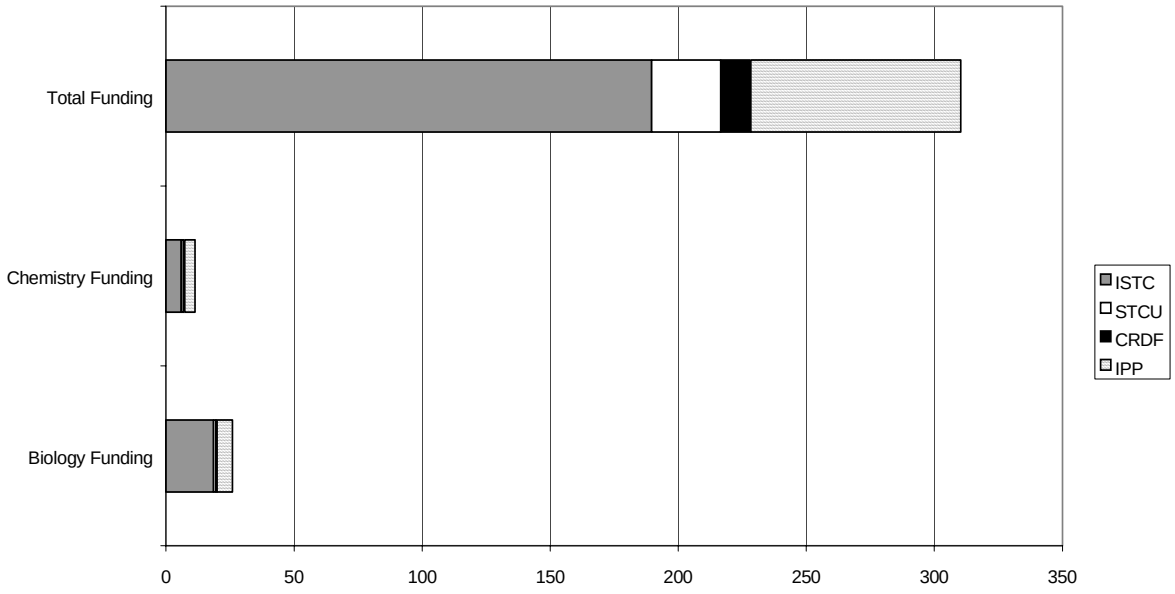
Number of Projects

under basic science, environment, or other grant categories, the funding pie would still have been divided unevenly between the major weapons of mass destruction disciplinary areas—nuclear, missile, chemical, and biological. This funding split is inconsistent with a balanced attack on the proliferation problems involving all weapons of mass destruction.

In the two larger grant programs, trend lines reflected moderate improvement in 1999 for biological weaponeers. At the ISTC, the number of biological grants has been on an upswing, from 7.9 percent in 1995 to 11.5 percent in 1997 and on to 16.5 percent in 1999.[148] The percentage of overall ISTC funding to biological grants has also advanced, as shown in Chart 3. From 1997 to 1998, new biological project funding went from $2.4 million to $5.3 million. In 1999, the ISTC awarded an addition $10 million in biological

[148] *1997 ISTC Annual Report*, 6. Data for 1995 and 1999 provided to the author by the International Science and Technology Center, 17 November 1999.

Chart 2: Comparison of Chemistry and Biology Project Funding With Other Technology Areas (1994–1998).



	Biology Funding	Chemistry Funding	Total Funding
IPP	6.00	4.00	81.90
CRDF	0.46	0.55	11.80
STCU	1.00	0.88	27.00
ISTC	18.50	5.90	189.60

Millions of Dollars

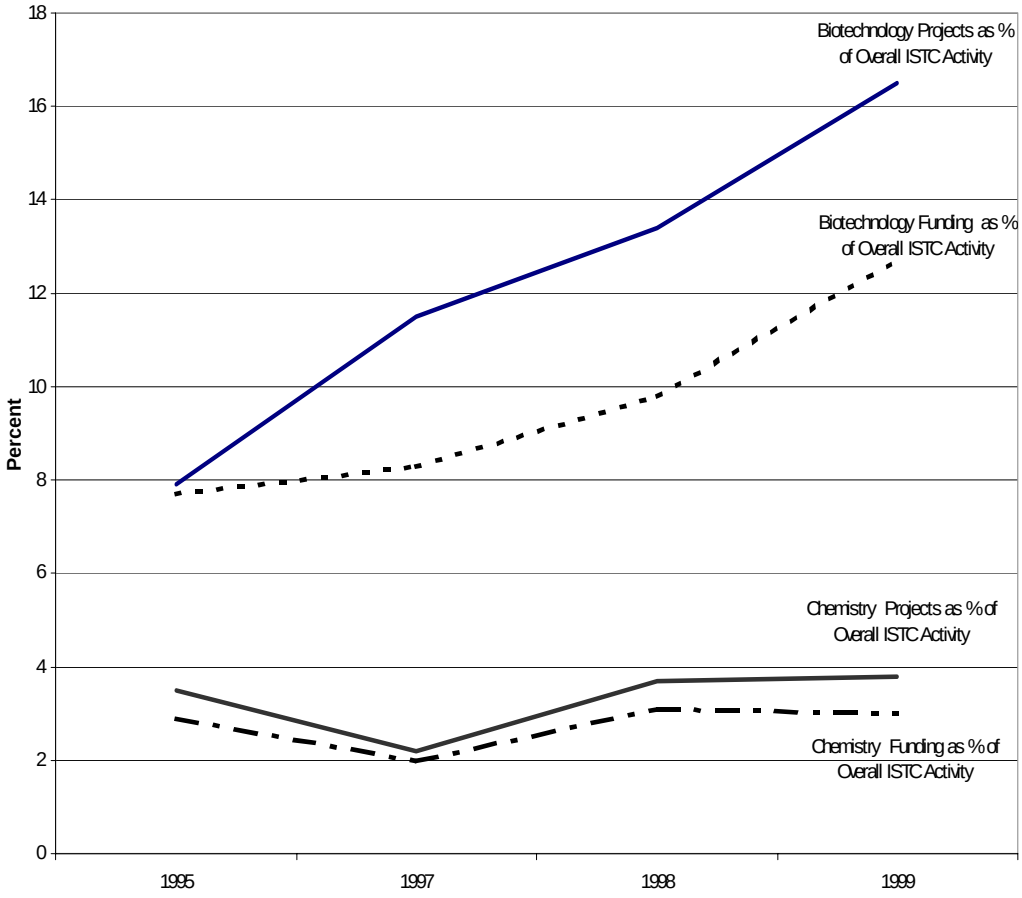
grants.[149] The IPP program had 233 active projects in September 1999, of which roughly fifty-five involved biologists and twenty-five chemists. At that time, scientists from 18 biological institutes and seven chemical institutes were associated in some way with IPP efforts. From 1997 to 1999, the IPP program oversaw a total of $15.5 million in grants to chemical and biological scientists. Of that amount, roughly $10 million applied to programming with biological scientists and $5.4 million to programming with chemical weaponeers.[150]

---

[149] *1997 ISTC Annual Report*, 7; *1998 ISTC Annual Report*, 5. Data for 1999 provided to the author by the International Science and Technology Center, 17 November 1999.

[150] The IPP program spent $6.9 million in fiscal year 1997, $3 million in fiscal year 1998, and $5.6 million in fiscal year 1999. Approximately 35 percent of the total went to chemists and 65 percent to biologists. Information provided to the author by the Initiatives for Proliferation Prevention Program Office, U.S. Department of Energy, 12 October 1999.

Chart 3: Chemical and Biological Projects and Funding as Percentage of Total ISTC Activity.



That a number of Russian biological weapons experts have worked in countries listed as proliferators is deeply disturbing to some, evidence to others that the brain drain proliferation grants have failed. The ISTC and other grant programs, however, were never meant to be a guarantee that no leaks from the weapons institutes would ever occur. Given the many thousands of scientists involved, such a standard would be impossible to uphold. Rather, these collaborative research programs were intended to make it easier and preferable for Russian and other former weapons scientists to stay at home, feed their families, and live with dignity without having to sell their weapons skills or materials to proliferators.

Accordingly, one former U.S. official rated the ISTC a success because it has "prevented a flood."[151]

Explanations for the Skew

The statistics given in the previous section of the report highlight that the ISTC, STCU, CRDF, and IPP programs were, in the words of one U.S. official, "too slow to get started in the biological and chemical areas and have not been expanding quickly enough."[152] Individuals close to these grant programs listed a number of reasons why comparatively few research grants have been aimed at biological and chemical scientists. First, the emphasis in funding naturally gravitated toward the nuclear and missile areas because nuclear weapons were the centerpiece of global security concerns throughout the Cold War.[153] Even if the funding governments had not had a tendency to concentrate first on nuclear proliferation problems, it was easier in many ways for the grant programs to engage the Russians and other countries in the nuclear area because the Soviet nuclear community was much better known than the chemical and biological weapons programs. Strategic nuclear negotiations dating to the late 1960s had established communications channels between the U.S. and Soviet nuclear scientists; in the 1980s, this interaction intensified with joint experiments on how to monitor nuclear treaties. Thus, the grant programs could more readily identify the key nuclear institutes and individuals that should be brought into the grant-making program.[154] Similarly, a lengthy relationship between the U.S. National Aeronautics and Space Administration and the Soviet space program gave the grant organizations a base to build upon for grants to missiliers.

In contrast, the U.S. intelligence community knew less about the former Soviet biological and chemical complexes, which made it more difficult in the early years to fund collaborative research in these areas. The inherent dual-use nature of many biological and

---

[151] This same individual observed wryly that former Soviet scientists might not be the only ones tempted by well-paying offers from would-be proliferators. "If the price is high enough, they'll go from Los Alamos too." Former U.S. government official, 13 April 1999 interview with the author.

[152] 24 May 1999 interview with the author.

[153] U.S. government official, 19 May 1999 interview with the author.

[154] Harrington, "Redirecting Biological Weapons Expertise," 3; senior ISTC staff member, 16 September 1999 interview with the author.

chemical activities also made it harder for the funding governments to discern how to allot grants in these weapons complexes. As one individual put it, "unlike the nuclear community, the problem had no sharp borders. Almost every chemical and biological institute in the former Soviet Union had at least some small-scale defense work."[155] The United States, which has a plethora of nuclear weapons specialists to work with their Russian counterparts, had far fewer chemical and bioweapons experts.[156] Other factors discouraging swift moves to fund chemical and biological scientists included the animosity generated by arms control and confidence-building efforts to pry open the gates of some tightly closed chemical and biological institutes.[157] In particular, the Russians refused to discuss biological weapons issues in bilateral channels, whether the topic was brought up by action officers at the working level or by Vice President Al Gore, Jr. in his talks with former Prime Minister Victor Chernomyrdin.[158] Yet a final reason why less funds have been invested in the chemical and biological projects is that nuclear-oriented proposals have always far outnumbered those from biological or chemical weapons experts.[159]

---

[155] Some institutes received just 2 percent of their funding from the Ministry of Defense. Senior ISTC staff member, 16 September 1999 interview with the author. Similar observations were made by a U.S. biodefense expert in a 21 May 1999 interview with the author.

[156] U.S. government official, 24 May 1999 interview with the author.

[157] In addition to the collapse of the 1992 trilateral agreement, the U.S. and Russian governments were at odds over the implementation of the 1989 Memorandum of Understanding and the 1990 Bilateral Destruction Agreement. The former accord committed both sides to exchange data and engage in joint verification experiments to test monitoring concepts for the chemical weapons ban. The U.S. government asserted that Moscow did not provide complete information about the *novichok* program in data exchanged in mid–1994, and the Russians challenged the accuracy of the U.S. data as well. Controversy also erupted in efforts to implement the Bilateral Destruction Agreement when Russia officials stated that they had already converted most of their chemical weapons production facilities to peaceful purposes. This accord is now dormant, and inspections of U.S. and Russian chemical weapons facilities are taking place under the Chemical Weapons Convention.

[158] The sole exception to this wall of silence was a willingness to talk about Stepnogorsk, the large biological weapons production facility located in Kazakhstan. U.S. government official, 24 May 1999 interview with the author.

[159] One U.S. government official estimated that 60 to 70 percent of the proposals submitted to the ISTC are from nuclear and missile scientists. U.S. officials have been making extra efforts to generate more proposals from chemists and biologists. U.S. government official, 19 May 1999 interview with the author.

MAKING MID-COURSE ADJUSTMENTS

When hard times began to hit the biological and chemical weapons complexes in 1992, the first to feel the pinch were the junior scientists and technicians, who lost their jobs in droves.[160] The younger generation ended up in banks, other commercial companies, or as budding entrepreneurs. Some, although apparently not too many, returned to graduate school.[161] For all intent and purpose, however, most of those who would have become the next generation of biological and chemical weaponeers have long since left the weapons institutes.

Although grants from the ISTC and similar programs enabled the rehiring of some younger personnel, for the most part those still at the institutes are mid- to late-career specialists. The bulk of grant applicants are in their 40s, 50s, or 60s.[162] Some have argued over whether the emphasis of grant assistance should be placed on the mid-career scientists who can be persuaded to turn their skills toward the market economy or on the older scientists who are more entrenched in the culture of the weapons complex. In this latter category are extremely knowledgeable individuals likely to be in or past the prime of their weapons careers, more reluctant to change their ways, and therefore of prime proliferation concern.[163]

At the outset, ISTC grants were driven by the need to reach the most experienced weaponeers as quickly as possible to demonstrate a viable alternative to sharing weapons-usable materials and expertise with proliferators—a strategy of containment. The thrust of the ISTC's initial grants, which centered around basic research and development projects, has been depicted as busy-work for the weapons scientists.[164] This "feeding the deer" approach is still appropriate for the most senior scientists because weapons work is all that they know and the odds of a successful career change are remote. The unwritten goal with

---

[160] Senior chemist, 15 September 1999 interview with the author.

[161] ISTC staff member, 16 September 1999 interview with the author. At first it was thought that many of the younger scientists who lost their jobs returned for higher degrees, but apparently that was not the case. Before the collapse, thirty individuals people applied for every science graduate program slot at Moscow University. In 1994, applications were down to 1.5 candidates per place. By 1999, a gradual rebound had begun, with applications averaging five or six prospective students per place. Biological institute deputy director, 17 September 1999 interview with the author.

[162] ISTC staff member, 16 September 1999 interview with the author.

[163] For a synopsis of this debate, see Harrington, "Redirecting Biological Weapons Expertise," 4.

[164] U.S. biodefense expert, 21 May 1999 interview with the author.

these older weaponeers is simply to prevent them from leaving their institutes; the expectation is that they will retire under the ISTC umbrella.[165]

With regard to the mid-career scientists, however, a few years of experience led to the realization that a containment strategy alone was insufficient. Not only did the ISTC have middle-aged weapons experts on its hands, the first results from ISTC-sponsored research began to come out of the laboratories in 1997. Faced with a growing stack of results and a growing roster of grantees who would need employment for twenty to thirty more years, those working at and with the ISTC had to answer the proverbial question of "now what?" Replacing reliance on a paycheck from Moscow with dependency on scientific welfare from the ISTC was unacceptable to the ISTC's funders and nonconstructive for the institutes themselves. Even though no firm date was ever articulated as to when the ISTC would close its doors, the need to devise what might be called an "exit strategy" was recognized.

So, necessity gave rise to the addition of a strategy to nurture and indeed push some scientists and the institutes toward self-sufficiency. With the mid-career scientists, the ISTC has begun to emphasize projects with commercial potential and private sector contacts so that these weaponeers can merge into the legitimate business arena, able to get along without ISTC and government support.[166] This second strategy is embodied in collaborative research with commercial partners program and the expansion of ISTC training programs in business and manufacturing standards. As for the IPP and CRDF programs, the former adopted a pro-commercialization strategy from the outset and the latter also stresses research with a potential commercial payoff.

Commercialization and Self-Sufficiency

[165] Senior ISTC staff member, 16 September 1999 interview with the author. Another ISTC staffer observed that the older scientists appear to tolerate begrudgingly the commercial aspects of their ISTC grants. "These scientists want to make science, not some commercial product." ISTC staff member, 16 September 1999 interview with the author.

[166] Among the ISTC's funders, the European Union tends to favor containment, the Japanese the partners program, and the United States the self-sufficiency and commercialization efforts. U.S. government official, 19 May 1999 interview with the author; U.S. biodefense expert, 21 May 1999 interview with the author; senior ISTC staff members, 16 and 21 September 1999 interviews with the author; ISTC staff member, 17 September 1999 interview with the author.

Opinions differ as to whether it will be more difficult to redirect the chemical institutes into the development and production of consumer goods or the biological weapons institutes into civilian commercial, agricultural, and public health activities.[167] Regardless of whether one complex would be easier than the other to realign, the ISTC began trying to jump start the transition of the weapons scientists in mid–1997 by teaming them with Western counterparts who are well-versed in commercial applications of science, not to mention the highest laboratory and manufacturing standards.[168] This commercialization effort, called the partners program, centers around Western commercial companies, universities, or government agencies that are required to put their own resources into joint research projects with the weapons scientists. In 1998, the ISTC added twenty-nine new partners, bringing the total to forty-five. The ISTC's stable of commercial partners includes such household names as 3M, Bayer AG, Dow Chemical Company, E.I. DuPont de Nemours, and Rhone-Poulenc Industrialisation, among others.[169] DuPont, for instance, already has three partners projects underway with the Institute of Chemical Physics in Chernogolovka, the Institute of Organic Chemistry in Moscow, and the Institute of Organo-Element Compounds, also in Moscow.[170]

While the ISTC has managed to recruit some companies for its partner program, there have been obstacles in getting it off the ground. Persuading Western companies to participate as research partners has not been easy. Major Western companies that lost

---

[167] According to one school of thought, biotechnology companies are more accustomed than chemical corporations to investing significant sums in riskier ventures in an effort to get a big payoff. Consequently, persuading the biotechnology and pharmaceutical firms to collaborate with the biological weaponeers should be relatively easy. Former U.S. government official, interview with the author, Washington, D.C., 15 November 1999. Another school of thought holds that the major Western chemical companies can readily work with institutes chocked full of chemists who specialize in organophosphorous compounds—expertise that transfers easily to a number of commercial products. Western firms may also appreciate that some chemical institutes maintain excellent libraries of chemical compounds, which may prove very useful in creating new products. Within the biological weapons complex, however, many of the weapons scientists are experts in filoviruses and other dangerous pathogens. They may find the transition to the commercial marketplace more difficult because only a handful of Western organizations engage in dangerous pathogens research. U.S. government official, 19 May 1999 interview with the author.

[168] The ISTC's partners program was foreshadowed in 1990, when a British company began working jointly with Vector's Institute of Molecular Biology on potential medical products. Rimmington, "From Military to Industrial Complex?" 91.

[169] *1998 ISTC Annual Report*, 3.

[170] Seltzer, "Moscow Science Center Lauded," 30.

money attempting to invest in former Soviet states in the early 1990s are reluctant to have another encounter with sometimes impenetrable regulations and bureaucracies.[171] The taint of working in former weapons facilities also discourages some Western corporations, as does the poor construction of the facilities concerned, the lack of good manufacturing practices, and the need of former Soviet weaponeers to learn basic business marketing and managerial skills.[172]

Important incentives for Western companies to become ISTC partners are that all projects are screened by the ISTC's member governments, are audited, and have tax- and customs-exempt status. Projects are conducted under legally binding project agreements and intellectual property rights are protected.[173] In these somewhat unpredictable economic and political circumstances, the ISTC thus offers the safest possible mechanism for establishing working relationships with important scientific institutes. Western partners, however, have been warned not to expect to pluck products off the vine. Rather, the partners are making longer-term investments, gaining access to excellent science and cost-effective labor that will yield discoveries and markets down the line.[174]

To facilitate sound working relationships with Western firms, the ISTC is offering programming to the weaponeers and their institutions designed to make them more knowledgeable and desirable business partners. For instance, the ISTC has deployed teams of Western specialists to acquaint the weaponeers to business practices and laboratory and manufacturing standards.[175] Understanding of intellectual property rights and how inventions are handled and marketed in the West, not to mention achieving certification of Good Laboratory Practices and Good Manufacturing Practices, will pave the way for the

---

[171] Former U.S. government official, 13 April 1999 interview with the author; U.S. government official, 19 May 1999 interview with the author.

[172] Harrington, "Redirecting Biological Weapons Expertise," 4. In the words of one ISTC insider, "the Russians have no clue about how to do business in an orderly, legal way." The Russians do not know how to determine fair market value for their labor and their products, much less how to sell them. Their instinct is to resort quickly to the back-scratching, back-channel practices that underpinned the USSR's command economy. Former U.S. government official, 13 April 1999 interview with the author.

[173] These and other benefits of partnership are listed in the pamphlet "New Opportunities for R&D Partnerships in the New Independent States" (Washington, D.C.: U.S. Department of State, n.d.).

[174] U.S. government official, 19 May 1999 interview with the author.

[175] U.S. government official, 19 May 1999 interview with the author; U.S. biodefense expert, 21 May 1999 interview with the author.

substantial growth of collaborative projects over the long term. A few facilities have been given special training grants to enhance their laboratory and manufacturing practices. For instance, a program began in 1999 to send personnel from a half dozen biological institutes to the United States for training in the strict guidelines for experiments involving animals. These special grant additions will also upgrade the vivariums at these laboratories, replacing basic equipment like animal cages, improving ventilation, and helping the scientists to develop rigorous animal breeding programs. The Pushchino Branch of the Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry, then Lyubuchany, Vector, and Obolensk will receive this animal standards training. The ISTC is helping to develop international animal use standards that combine U.S., European, and Japanese practices, and in mid–1999 Russian scientists formed a national animal care and use committee to oversee animal experimentation activities in Russia.[176]

Bringing former Soviet facilities up to Western laboratory and manufacturing standards will be a gradual process that some institutes will find easier than others. At GosNIIOKhT in Moscow, for instance, a project was undertaken with a U.S. company in 1999 using Western protocols, which the Russian chemists quickly learned.[177] The transformation will be slower in facilities requiring significant renovation or the purchase of major pieces of equipment than in those where the scientists can simply adopt new laboratory practices.

In the meantime, the ISTC is making it possible for the weapons scientists to interact with scientists overseas through its project development grants program. Among other activities, travel funds allow the scientists to present their project proposals at conferences.[178] In 1998 and 1999, about one hundred scientists biologists and chemists

---

[176] Pushchino was selected to inaugurate the improved animal standards program because it has the most modern vivarium, built a decade ago with assistance from Finnish and Slovenian companies. Pushchino is applying for accreditation in animal standards from the certifying organization in the West, the International Association for Assessment and Accreditation of Laboratory Animal Care. Pushchino has also already conducted its own animal standards training session for scientists from other institutes. The animal standards committee, which is recognized and sanctioned by the Ministry of Health, will review the protocols of all laboratories that conduct animal experiments. Biological institute deputy director, 17 September 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author.

[177] Chemist, 15 September 1999 interview with the author.

[178] In 1997, the ISTC budgeted $39,000 for project development grants. *1997 Annual Report on U.S. Government Assistance to and Cooperative Activities*, 136.

came to the United States on ISTC travel grants to meet with U.S. companies and universities.[179] Bringing the scientists to the West to see potential research partners is easier than getting the companies to travel in the opposite direction. These face-to-face consultations have introduced Western firms to the wealth and quality of the science in the chemical and biological weapons complexes.[180] These trips have also helped to break the isolation of the weapons experts and acquaint them with Western ethics and scientific standards. Establishing ongoing relationships with Western partners is the "best window into what is going on today at these laboratories."[181]

In March 1997, the ISTC began trying to encourage weapons scientists to make their way into the commercial arena with a variety of training programs. As projects with commercial potential come to a close, the scientists involved may receive funds to attend business training courses that range in length from two days to two weeks. Between fifteen and thirty scientists participate in these business training seminars.[182] The ISTC provides introductory bilingual business training to its grantees. In some cases, the ISTC adds a training component to a particular grant to enhance its business prospects. Some project managers receive ISTC assistance to go to Europe, Japan, or the United States for extended training in how to build a small business. The ISTC is in the process of creating regional training centers outside of Moscow to make business training more accessible and cost effective.[183]

A featured subject in the ISTC's business courses is how to commercialize the results of scientific research. The former Soviet states lack a tradition of establishing intellectual property rights and taking science from the laboratory to the marketplace. During the Soviet era, inventions were registered, but the government owned all rights to

---

[179] Note that the ISTC buys the airplane tickets for scientists when they travel, so it is difficult for them to abuse travel funds. U.S. government official, 24 May 1999 interview with the author.

[180] U.S. government official, 19 May 1999 interview with the author.

[181] U.S. government official, 24 May 1999 interview with the author.

[182] The ISTC's budget for the business training program in 1997 was $26,000. *1997 Annual Report on U.S. Government Assistance to and Cooperative Activities*, 136.

[183] Regional training centers will be situated in areas where ISTC projects are concentrated. The ISTC may also begin offering project participants courses in spoken English and business language. Senior ISTC staff member, 20 September 1999 interview with the author. For more on the ISTC's training programs, see *1998 ISTC Annual Report*, 9.

them. The Russian has government created a new legal infrastructure for intellectual property rights, modeled on the European system, and the Russian patent office became an independent agency in July 1999. Only a handful of attorneys are experienced in licensing issues, however, which makes it difficult to enforce cases of patent infringement. Still lacking as well is a widespread understanding of intellectual property rights and the patenting process. According to a U.S. government legal expert, "there is a lot of misunderstanding among the Russian scientists and even among the Russian attorneys" about the basic legal terminology and process involved in licensing inventions.[184]

One of the biggest myths among the weapons scientists about getting science to the market relates to the costs of patenting an invention. One scientist recounted a horror tale of having to pay tens of thousands of dollars to prepare the appropriate paperwork to license a product.[185] However, in mid–1999 the fee to apply for a patent was 165 rubles—approximately $7.[186] The ISTC established a special $50,000 annual fund in March 1997 to provide various services to help scientists protect their intellectual property rights and begin the process to patent their ideas. For instance, scientists can receive instructions on the appropriate documentation procedures to buttress their patent application. Those wishing to patent an invention resulting from ISTC-sponsored research can apply to the ISTC for assistance with the patent application form. The ISTC's costs to prepare the paperwork to file an application are roughly $400.[187] After the application is filed, the scientist is responsible for subsequent costs to prosecute the application as well as any maintenance fees. The total expense to patent an invention should be approximately $1,000, not thirty times that amount.[188]

---

[184] Interview with the author, Washington, D.C., 17 November 1999. Remarks about the relative immaturity of the intellectual property rights system in Russia were also made by an ISTC staff member, interview with the author, Moscow, 21 September 1999.

[185] According to a senior biological researcher, it costs $30,000 to $40,000 to complete the licensing process. 17 September 1999 interview with the author.

[186] ISTC staff member, 21 September 1999 interview with the author.

[187] Ibid. The steps that scientists need to take to document their invention and the forms that are required are contained in "Instructions for this process are clearly outline in Handbook for the Treatment of Intellectual Property by CIS Institutes under ISTC Project Agreements," mimeo, 10–08–97 DRAFT (Moscow: International Science and Technology Center, 8 October 1997).

[188] U.S. government legal expert, 17 November 1999 interview with the author.

The Commercial Dimensions of the IPP and CRDF Programs

The utility of concentrating on research with commercial prospects was embedded in the IPP program from its origin in 1994. The IPP program supports three phases or "thrusts" of research. In first phase efforts, former Soviet weaponeers and U.S. scientists jointly develop the project concept and conduct initial research to validate its commercial potential. As of the end of 1998, the IPP program had thirty-nine phase one projects underway involving chemists and biologists.[189] In phase two projects, the Energy Department brings in a partner from the private sector to share costs and provide technical and commercialization assistance. Since private industry is involved at this fairly early stage, one Russian scientist described the projects in the IPP program as commercial "by definition, by birth."[190]

By April 1997, over sixty phase two projects were underway in the IPP program.[191] Ten of these phase two projects in progress at the end of 1998 involved chemical and biological weaponeers.[192] In phase two projects, the industry partners pay their own way. For every $1 that the IPP has put into these second phase projects, the commercial partners have invested $1.65. U.S. companies, which are required to provide at least 50 percent of the costs for phase two projects, had given $64 million in funds and in-kind resources by mid–1999. At that juncture, the number of phase two projects was eighty and some seventy-nine U.S. companies, including Exxon, DuPont, and Boeing, were phase two partners. An entity known as the U.S. Industry Coalition underpins the IPP program, helping to recruit private companies to invest in commercial research projects involving former Soviet weapons scientists.[193]

---

[189] Information provided to the author by the Initiatives for Proliferation Prevention Program Office, U.S. Department of Energy, 12 October 1999.

[190] Biological institute deputy director, 16 September 1999 interview with the author.

[191] "Initiatives for Proliferation Prevention," 2.

[192] Information provided to the author by the Initiatives for Proliferation Prevention Program Office, U.S. Department of Energy, 12 October 1999.

[193] "Initiatives for Proliferation Prevention," 2; "The Role of the U.S. Department of Energy National Laboratories," 3. One close observer of the IPP program noted that the Industry Coalition did not function as it was intended at the outset because the national laboratory scientists wanted as large a role as possible in the projects. U.S. biodefense expert, interview with the author, Washington, D.C., 23 November 1999.

The most successful IPP projects graduate to a third phase, wherein they become free-standing commercial endeavors. During this stage, IPP investment is completely overtaken by the contributions of the private collaborating firm and the profits that the research results begin to generate. Remarked one individual, "IPP always had a clear exit strategy for the government, which was the commercialization phase three" hand-off to the private sector.[194] Five projects had made it to phase three status by mid–1999, although no IPP projects with scientists from the chemical and biological institutes had reached that stage. Energy Department officials expect fourteen more projects to move into phase three commercial takeoff in the 2000 to 2001 time frame.[195]

In response to criticism,[196] the Energy Department revamped the IPP program in 1999 to place even more emphasis on research with commercial potential. The percentage of IPP funding devoted to phase two projects had risen from 37 percent in 1994 to 67 percent in 1999. Moreover, the Energy Department established a policy that only phase two projects with commercial partners in place will be funded.[197]

CRDF also awards its grants under both the general cooperative and biomedical grant programs with an eye toward commercialization of the research results. Industry experts review of proposals, and U.S. companies collaborate on projects in the biomedical area. CRDF also helps scientists to interact with potential collaborators at scientific and industrial conferences. By the end of 1997, CRDF had administered about $470,000 in travel grants to 193 scientists from nine countries.[198] A special subsection of CRDF's travel grant program has taken over 110 scientists from nineteen biological and chemical institutes abroad for seminars and meetings. CRDF arranges the itinerary for these scientists, but the

---

[194] U.S. biodefense expert, 23 November 1999 interview with the author.

[195] Information provided to the author by the Initiatives for Proliferation Prevention Program Office, U.S. Department of Energy, 2 August1999.

[196] The General Accounting Office also pointed out the need to emphasize research with commercial applications, raised questions as to whether scientists on IPP grants were still involved in weapons work, and stated a need for an improved review process for chemical and biological proposals. See *Concerns With DOE's Efforts to Reduce the Risks.*

[197] Information provided to the author by the Initiatives for Proliferation Prevention Program Office, U.S. Department of Energy, 2 August1999.

[198] Travel grants pay for airfare and per diem, and recipients are required to file trip reports. *1995–1997 CRDF Program Report*, 36, 38.

actual travel funds come from the ISTC's travel grant budget.[199] In addition, CRDF enables scientists working on projects with industrial applications to receive business and management training. CRDF also has a next steps to market program aimed at facilitating the commercialization of research results, but none of the awards to date have involved scientists from the chemical or biological institutes.[200]

Commercial Spin-Offs

When canvassing some of the chemical and biological weapons institutes, evidence can be found that they are reconfiguring to facilitate commercial activity. The institutes are attempting to become hybrid organizations that conduct some research but also spin off so-called "daughter" businesses intended to be profit centers that help support the main institute's research. This approach is easier to initiate in some situations than in others. At Obolensk, for instance, such a transition has been slow getting underway because of uncertainty on the part of Obolensk's conservative senior management as to whether their institute will continue to be mainly a government research facility or should try to break totally with its past to become a private enterprise. Apparently, only one significant spin-off company, called Culture Media, has been established on the grounds of Obolensk. This company, which rents buildings and equipment from Obolensk, produces more than forty types of growth media for biological products, such as pharmaceuticals. In 1995, Culture Media manufactured fifteen tons of product. By 1999, production had risen to fifty tons and Culture Media had captured over 40 percent of the Russian market for growth media.[201] Independent of its ISTC-sponsored research projects, Obolensk has reportedly approached several foreign companies about joint business ventures.[202]

---

[199] By the end of November 1999, these trips had resulted in the development of over sixty new proposals to the ISTC and more than 110 pending proposals and collaborations with U.S. companies, university scientists, and U.S. government agencies. CRDF staff member, interview with the author, Washington, D.C., 30 November 1999.

[200] Business training includes intellectual property rights, business plan preparation, and technology demonstration techniques, among other topics. In the next steps program, the commercial collaborators share in the project costs and agree to repay CRDF's share of the bill if the resulting products make a profit. *1995–1997 CRDF Program Report*, 44–5.

[201] Culture Media also interacts with similar companies overseas producing culture medium for the international market. Senior biologist, 16 September 1999 interview with the author; senior biological researcher, 17 September 1999 interview with the author.

[202] Obolensk is also attempting joint ventures with German and Israeli pharmaceutical companies, as well as with partners in Vietnam. Obolensk is also apparently working with the Chinese on interferon production projects as is Vector. Sergiev Posad has been working on tableted vaccines with the Hyundai

Not far from Obolensk, other spin-offs are being created. One, the Research Center of Toxicology and Hygienic Regulation of Biopreparations at Serpukhov, specializes in the aerosolization of extremely small particle sizes. The Serpukhov staff works mostly on contracts, such that specific scientists from several nearby institutes are hired on an as-needed basis for individual projects and their employment terminates once a project concludes. Furthermore, Serpukhov has created a small division that focuses on the activities that the scientists themselves usually do not excel at, namely the writing and marketing of proposals. Apparently, business is brisk enough that ISTC grants are a supplementary, not principal, source of funds for Serpukhov's scientists.[203]

Still other biological institutes are beginning to transform to commercial activities. For instance, commercial manufacturing endeavors at the St. Petersburg Institute of Highly Pure Biopreparations began to show profit in 1998. The first of the institute's three products is a recombinant protein called Interleukin 1 beta, which was developed with ISTC grant assistance. The Interleukin 1 beta helps cancer patients reconstitute bone marrow cells after chemotherapy and radiation. Profits from 1998 production went to pay creditors and were reinvested in production capabilities. Although only a small profit was generated in 1999, new treatment applications for this protein are being explored. A relatively inexpensive medicine for aiding digestive irregularities is the second product being made at this St. Petersburg institute. This medicine, called Vitaflor, has earned $5,000 in profits. The third product, the recombinant protein Erythropoietin, is made in cooperation with another private firm. Erythropoietin has been much more successful in the marketplace, with sales of $80,000 in 1998. Consequently, the institute has entered into licensing agreements with Asian and Latin American companies for the production of Erythropoietin.[204]

---

company, based in South Korea. Rimmington, "From Military to Industrial Complex?" 93–4.

[203] Serpukhov does not have significant financial problems, with ISTC grants providing about 30 percent of staff salaries, plus some equipment purchases. Serpukhov "inherited" aerosolization equipment from Obolensk that creates particle sizes of one to five microns. The commercial niche for this facility ideally is the research and development of medications delivered by aerosol spray, as opposed to orally or by inoculation. These contractual working arrangements enable the Serpukhov staff to select the best qualified scientists and to gain access to the equipment and reagents at the collaborating institutes. Serpukhov's Division of Commerce and Scientific Relations with Foreign Countries employs five. Biological institute director, 17 September 1999 interview with the author.

[204] Research on the Interleukin 1 beta began in 1989, when the institute created its own library of human-stimulated leukocytes and started genetic engineering with proteins. The technology for this recombinant protein was developed in 1996, clinical trials were completed in 1997, and production began in 1998. The 1999 profit for the Interleukin 1 beta was $2,000, but the ISTC grant 421R helped investigate a

Some noteworthy strides in transforming a large weapons institute into a commercial scientific research and manufacturing venture have also taken place at Vector. This laboratory has spawned a number of daughter companies, the largest three being Vector-Best, Vector-BiAlgam, and Vector-Pharm. Vector-Best manufactures a whole catalog of diagnostic kits for domestic and near-abroad markets, including kits for hepatitis, HIV, and veterinary use. Vector-BiAlgam, which is the only spin-off that is completely separate from Vector, churns out an enriched milk product for children. The profits from this endeavor are being poured back into equipment renovations that will enable blood products (e.g., anti-serum for tick-borne encephalitis) to be Vector-BiAlgam's next manufacturing endeavor.[205] The biggest spin-off company, Vector-Pharm, makes such products as antibodies and interferon. However, Vector-Pharm's most significant activity is to purchase bulk drugs made abroad, such as eyedrops and generic pharmaceuticals, and package them for sale to Russian consumers.[206] Vector-Pharm claims to have been ranked in 1998 as the tenth largest pharmaceutical manufacturer in Russia. Although Vector-Pharm reportedly generated nine million rubles of business in 1998, the amount of profits that these spin-offs generate is not well understood given the fluid state of the Russian economy. Furthermore, the extent to which the profits of daughter companies are reinvested in the operations and maintenance of Vector and other host institutes apparently varies from one spin-off company to another.[207]

Among the chemical weapons institutes, there are also some signs that commercialization efforts are beginning to take root. GosNIIOKhT earns approximately 50

---

secondary application for this protein as an immunostimulator the treatment of secondary immunodeficiencies acquired as a result of surgery, chronic disease, or other causes. Head of biochemistry laboratory, 17 September 1999 interview with the author.

[205] Former U.S. government official, 15 November 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

[206] Vector's repackaging lines take bulk drugs from Canada and Europe, put them into tablet form and appropriate containers, and then market and distribute the finished product. Ibid.; ISTC staff members, 15 and 20 September 1999 interview s with the author; head of laboratory, 17 September 1999 interview with the author.

[207] Note that the criteria for this survey and its rankings are not known. Furthermore, the definition of profits is also difficult to determine since labor prices and other cost factors are not firmly established in the Russian economy. Vector retains licensing rights on the products its scientists invent, and when daughter companies manufacture these items funds are fed back into Vector. U.S. government official, 24 May 1999 interview with the author; former U.S. government official, 15 November 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

percent of its current operating budget from the sale of ten medications.[208] The GosNIIOKhT branch at Shikhany has formed the Institute of Organic Synthesis Technology, which would like to engage in pharmaceutical and other commercial work. The commercial chemical company Khimprom has mostly absorbed the Volgograd and Novocheboksarsk branches of GosNIIOKhT. At the latter location, GosNIIOKhT employees are working on paint technologies.[209]

Aside from the birth of spin-off companies, another indicator of commercialization at the chemical and biological institutes is the pace with which inventions are being licensed. By mid-September 1999, the ISTC had submitted ninety-six patent applications in Russia and abroad on behalf of project scientists. From this total, chemists had filed seven applications and received one patent. Biologists had applied twenty-two times for patents and received five.[210]

Milking the Rattlesnake

For its part, the U.S. government has responded to indications that some bioweaponeers might have joined forces with aspiring proliferators by intensifying efforts to engage these scientists in collaborative research. When intelligence sources have revealed that Iran or other governments have tried to enlist the services of a particular scientist or institute, U.S. officials have traveled to those institutes to issue an ultimatum that *any* work with proliferators would disqualify that institute and its scientists from receiving *all* future U.S. and ISTC aid. U.S. officials have read the "riot act" to some ten biological institutes, clearly and aggressively articulating the consequences of working with proliferators versus the benefits provided by collaborative research grants. Instead of hoping that the weapons scientists will figure this out, said one U.S. official, the U.S. government is beginning to wield the ISTC "tool as a nonproliferation hammer."[211]

---

[208] These medicines, which are very strong sedatives, anesthetics, and cancer treatments, are sold domestically. Chemical institute director, 15 September 1999 interview with the author.

[209] Ibid.

[210] Statistics provided by the International Science and Technology Center, Moscow, 22 September 1999.

[211] U.S. government officials, 24 May and 2 August 1999 interviews with the author.

Washington also accelerated its efforts to draft key weapons scientists into joint projects by expanding research of work involving dangerous pathogens.[212] Drawing upon experts from the National Academy of Sciences, the Pentagon initiated this approach in 1996 using Cooperative Threat Reduction program funds. From 1997 to 1999, the Defense Department spent $5.5 million on joint dangerous pathogens research projects with scientists from Vector and Obolensk.[213] The Pentagon plans to continue sponsorship of four of the first eight pilot projects with Obolensk and Vector, and an additional fourteen projects are in the developmental and review stages. The U.S. Army Medical Research Institute of Infectious Diseases and the Naval Research Laboratory will be partners in this dangerous pathogens research, but other non-military U.S. research organizations (e.g., Centers for Disease Control, National Institutes of Health) are also being drafted as research partners. In 2000, some $4 million in Cooperative Threat Reduction funds will enable the expansion of this nonproliferation effort to the Research Center of Molecular Diagnostics and Therapy in Moscow, the Research Center of Toxicology and Hygienic Regulation of Biopreparations at Serpukhov, the Lyubuchany Institute of Immunological Engineering, the Institute of Highly Pure Biopreparations in St. Petersburg, and the Stavropol Anti-Plague Research Institute.[214] To some, working on dangerous pathogens with former weaponeers appears contrary to what the ISTC and its funders should be doing.

A U.S. official explained this strategy with the adage that in order to milk a rattlesnake, one has to grab it by the head.[215] Put another way, these very specialized weapons experts can most readily be engaged by working with them initially on what they

---

[212] In 1997, the U.S. government examined the balance of ISTC funding across the disciplinary areas and decided to put more emphasis on supporting the work of biological weaponeers as part of the Expanded Threat Reduction Initiative. U.S. government officials, 19 and 24 May 1999 interviews with the author.

[213] Using Cooperative Threat Reduction funds, the National Academy of Sciences sponsored eight pilot projects involving hepatitis C, monkey pox, hantaviruses, opisthorchiasis, tuberculosis, mycobacteriosis, and *Brucella arbortus*. The success of these pilot projects led the National Academy to recommend expanding this collaborative research with Russian scientists to a $10 million annual effort spanning a decade, which the National Academy would administer. See *Controlling Dangerous Pathogens: A Blueprint for U.S.–Russian Cooperation* (Washington, D.C.: National Academy of Sciences, October 1997). The Defense Department agreed to expand the program, but opted to sponsor some of the work itself, while encouraging other U.S. government agencies, such as the Centers for Disease Control and the National Institutes of Health, to sponsor other pathogens projects using Freedom Support Act funds. U.S. government official, 24 May 1999 interview with the author.

[214] U.S. government official, 24 May 1999 interview with the author.

[215] Ibid.

know best, then gradually redirecting them toward peaceful areas of research. The U.S. terms for these particular joint research projects require additional safeguards from the participating Russian institutes.[216] Depending upon the riskiness of the research, U.S. scientists will be in the laboratory with the weapons scientists at the very least when key experiments are done and in some cases for the duration of the entire project. Not only will this "aggressive, invasive oversight" provide significant transparency into these institutions, the U.S. collaborators are likely to learn things that will help improve U.S. biodefenses.[217]

One of the reasons that the ISTC grant program has begun to make inroads into these closed communities of weapons scientists is that it has been deliberately separated from the noncompliance assertions that have clouded efforts to move forward through arms control channels.[218] The Russian scientists appear to be very receptive to the idea that U.S. or Western scientists would work with them on an occasional or continuous basis in their laboratories, whether the projects involve dangerous pathogens or a commercial venture. The chemists and biologists questioned were ready to welcome commercial collaborators and for scientists from organizations such as the U.S. National Institutes of Health. As one scientist put it, "If they have the funds for this, no other problems exist."[219] The biological and chemical weaponeers exhibit a genuine and consistent enthusiasm for more interaction with their Western scientific collaborators. Even if it translates into less money for their research, they advocate allotting funds to enable their scientific collaborators to visit their

---

[216] The National Academy of Sciences noted that should work on dangerous pathogens proceed the ISTC's standard rules of access, which require twenty days notice, would be inadequate. "These rules were negotiated in the context of international cooperation on nuclear issues—namely, access to the closed atomic cities of Russia—and were focused primarily on ISTC's financial oversight responsibilities." National Academy of Sciences, *Controlling Dangerous Pathogens*, 18.

[217] Defense Department officials believe they may learn ways to improve U.S. vaccines, detectors, and therapeutics. U.S. non-governmental analyst, interview with the author, Washington, D.C., 18 June 1999; U.S. government official, 24 May 1999 interview with the author.

[218] Former U.S. government official, 13 April 1999 interview with the author; U.S. government official, 19 May 1999 interview with the author.

[219] Head of biochemistry laboratory, 17 September 1999 interview with the author. Observed one general director of a biological institute in a 17 September 1999 interview with the author: "In our field it is very easy to change and, so, very important to have openness and collaboration." Others with the same view included a chemist, 15 September 1999 interview with the author; senior biologist, 16 September 1999 interview with the author; head of a laboratory, 17 September 1999 interview with the author.

laboratories more often. These scientists rightly point out that it is less expensive to bring one Westerner to their laboratory than it is to take several researchers to the West.[220]

At some institutes, having scientific collaborators in situ is already a routine matter. One chemist has already hosted scientists from a U.S. company in a laboratory at GosNIIOKhT's Moscow branch for an extended period of time.[221] Also, officials from the World Health Organization are frequently present at Vector because of their involvement in multiple collaborative research projects.[222] The director of Vector, Dr. Lev Sandackchiev is a vocal advocate of turning Vector into a joint research center for collaborative work on microorganisms benign and dangerous. The director of Lyubuchany, Dr. Vladimir Zav'yalov, has a similar game plan.[223]

Ironically, the joint laboratory concept is skeptically received by some in the West, who believe either that offensive research would be conducted in a joint laboratory or that if a Communist government came back to power, Western scientists would be expelled.[224] Given the transparency inherent in a joint laboratory, it would be a most unlikely location for offensive activities. Furthermore, bypassing the opportunity to have around-the-clock access to these sites on the chance that a future election might install an ultra-conservative government would appear to be an overly cautious approach.

Aside from the willingness to allow more transparency at Biopreparat facilities, the still-closed biological institutes at Kirov, Sergiev Posad, Yekaterinberg, and St. Petersburg

---

[220] Chemist, 15 September 1999 interview with the author; senior biological researcher, 17 September 1999 interview with the author; biological institute director, 17 September 1999 interview with the author.

[221] Chemist, 15 September 1999 interview with the author.

[222] The World Health Organization, which has designated Vector as one of two laboratories globally to be a repository for smallpox, is working with Vector on the development of a measles vaccine in tablet form, an oral hepatitis vaccine, and treatments for AIDS and multiple drug-resistant tuberculosis. Head of laboratory, 17 September 1999 interview with the author; former U.S. government official, 15 November1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

[223] U.S. government official, 24 May 1999 interview with the author; head of laboratory, 17 September 1999 interview with the author; former U.S. government official, 15 November 1999 interview with the author; biological institute director, 17 September 1999 interview with the author.

[224] ISTC staff member, 15 September 1999 interview with the author.

have begun expressing interest in collaborative research projects with the U.S. government. The scientists in these institutes have heard how their colleagues in the Biopreparat facilities have already begun to benefit from the opportunities that ISTC grants offer to enter the commercial marketplace.[225] Key officials from the military institutes have agreed to a substantive collaboration with the U.S. Army Medical Research Institute of Infectious Diseases, probably beginning with the bacteriologists from Kirov and the virologists from Sergiev Posad. The terms of collaborative projects between U.S. biological defense experts and the scientists from the four military institutes will be explored as the scientists from these institutes participate in a series of reciprocal visits. Terms for the initial visit to the U.S. biological defense research center at Ft. Detrick, Maryland, were under discussion in the final quarter of 1999.[226]

Some would question why the United States, which long ago ceased offensive weapons development and production, should allow access to U.S. defense sites. Westerners tend to overlook the possibility that the former Soviet weapons scientists do not necessarily believe that offensive chemical and biological programs no longer exist in the West. Indeed, one need not search too hard to find Russian scientists convinced that the United States still maintains an offensive biological weapons program. One such individual described Pine Bluff Arsenal in Arkansas as "an excellent facility for the development of biological weapons."[227] U.S. experts working with the Russians have come to recognize that mistrust is a two-way street.[228] Cooperative projects are important because they build trust both ways.

---

[225] U.S. government officials, 19 May 1999 and 24 May 1999 interviews with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

[226] U.S. government official, 24 May 1999 interview with the author. These reciprocal visits were agreed to in principle during a 17 December 1998 meeting at the Russian Military Academy of Radiological, Chemical and Biological Defense in Tambov. Tucker, "Bioweapons from Russia," 38.

[227] Biological institute general director, 17 September 1999 interview with the author. Similar remarks were made by an ISTC staff member in a 16 September 1999 interview with the author. Of course, other Russian scientists believe that the United States ended its offensive program as President Richard Nixon directed and that the USSR kept its program going until the Soviet government disappeared. ISTC staff members, 15 and 17 September 1999 interviews with the author.

[228] "The more time I spent with them, the more I came to believe that they trusted us no more than we trusted them. They are extremely paranoid about us." U.S. biodefense expert, 21 May 1999 interview with the author. Remarked a U.S. biodefense expert, "It has taken so long to build this level of trust. We are just about to break the ice and make real progress." 23 November 1999 interview with the author.

Physical Security and Accountability at the Weapons Institutes

Aside from concerns about brain drain, the main worry about the chemical and biological institutes is that poor security and accountability would enable theft or diversion of weapons-usable materials (e.g., dangerous pathogen seed cultures, guidebooks for weapons production) onto the black market. Observed the director of one biological institute, "Now it is possible to buy strains because the scientists are working without bread."[229] The institutes operate under a concept of security known as perimeter-in access, which combines physical access control with some of the safety practices required for working with toxic substances and dangerous pathogens. Exact security procedures vary from site to site.

Perimeter fences are the first line of defense. Some institutes employ electronic monitoring devices, such as video surveillance cameras and vibration sensors on the perimeter fences that would detect unauthorized attempts to enter the facility. Others do not, and the electronic monitoring devices that are in place are quite old. Armed guards at the entry/exit gates require the presentation of identification. Employees must show badges, and visitors are allowed access by appointment only. Guards search briefcases and bags at some sites, but not at others. Guards are also posted at the entrances of high-security buildings inside the perimeter fence (e.g., biosafety laboratories, administrative buildings). Visitors need a specific permit to enter, and employees must show a building-specific pass. Personal property is searched again at this stage at some sites. Entry to a biosafety laboratory with dangerous pathogens is regulated by specific permits and the appropriate vaccination status.[230]

When employees exit laboratories, buildings, or the main perimeter gates, guards apparently do not engage in any regular examination of their personal belongings. The more

---

[229] Interview with the author, 17 September 1999.

[230] One individual observed random guard patrols inside compounds where deadly materials are present, others did not recall such patrols. Employees are permitted to work in a particular building or group of buildings; only the passes of senior managerial personnel allow entry into all buildings within a compound. U.S. government official, interview with the author, Washington, D.C., 12 November 1999; Dr. Vil Mirzayanov, 28 April 1999 interview with the author; U.S. government officials, 24 May 1999 interview with the author; Dr. Ken Alibek, 5 June 1999 interview with the author;biological institute director, 17 September 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author; ISTC staff member, 20 September 1999 interview with the author; U.S. government official, 15 November 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

senior an employee, in fact, the less likely guards are to delay an individual with a personal property check.[231] Another factor that should be acknowledged is that guards are likely to be more motivated to perform their duties thoroughly if they are well-paid. In 1999, guards at these institutes were being paid only part of their salary, some on time and some delayed.[232]

In addition to physical barriers and intrusion detection measures, one of the main foundations of security and accountability is in the selection of personnel. Scientists with access to sensitive areas of the biological and chemical institutes underwent a complete security-risk evaluation. Their suitability for remaining on the job was re-evaluated periodically.[233] Some basic biosafety practices also double as security measures. Scientists were required to keep logs of their activities, recording what types of experiments they conducted and when they worked with various agents and pieces of equipment. Also, as a rule those working in biosafety laboratories work in pairs and wear cumbersome "moon" suits that have no pockets or places to tuck items large or small. They enter and exit a high-level biosafety suite together. When leaving the biosafety suite, the workers doff their protective suits and shower before changing into street clothes. A bootlegger would have to conspire with his laboratory partner or be deft enough hide the contraband from them in relatively close quarters.[234]

According to veterans of the chemical and biological weapons complex, the security and safety procedures described above provide insufficient barriers to a determined smuggler. Mirzayanov, a seasoned individual from the Soviet chemical weapons establishment concluded, "If you want to take something out from GosNIIOKhT, it was very

---

[231] Dr. Vil Mirzayanov, 28 April 1999 interview with the author; U.S. government official, 24 May 1999 interview with the author; Dr. Ken Alibek, 5 June 1999 interview with the author; biological institute director, 17 September 1999 interview with the author.

[232] U.S. government official, 24 May 1999 interview with the author; biological institute director, 17 September 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

[233] Dr. Ken Alibek, 5 June 1999 interview with the author; ISTC staff member, 16 September 1999 interview with the author; head of laboratory, 17 September 1999 interview with the author.

[234] U.S. government official, 24 May 1999 interview with the author; Dr. Ken Alibek, 5 June 1999 interview with the author; head of laboratory, 17 September 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

easy."[235] A seed culture of a dangerous pathogen can be secreted into a tiny vial, since even one-half a milliliter of agent is all that is needed to grow devastating quantities of a disease. In one documented case from 1984, a major by the name of Anisimov secreted an ampule of genetically altered tularemia out of a biosafety laboratory at Sverdlovsk in order to jump start his research at his new position in Obolensk.[236] Although security at the institutes was arguably tighter in the 1980s, such an incident could occur because accountability practices were not very strong to begin with and workers entered the laboratories alone at times. Furthermore, Alibek recalled, "It was not possible for managers to check every single day what researchers were doing because the amount of material they were dealing with was enormous."[237]

While the security at these institutes can certainly be improved, some perspective on this matter can be obtained by understanding that the Centers for Disease Control and the U.S. Army Medical Research Institute of Infectious Diseases employ essentially the same approach to safety and security—extensive background checks on workers, physical security barriers like fences, building and laboratory access controlled by pass-only entry, and the pair rule when working in dangerous pathogens suites, among other precautions. Personal property is not checked on entry or exit from Ft. Detrick. These premier U.S. biosafety level-four laboratories are not entirely smuggle-proof, either.[238] Furthermore, the media reports tend to emphasize the vulnerability of the former Soviet institutes, making it appear as though someone could just walk in and take a seed culture. At Vector, access to the agent

---

[235] Dr. Vil Mirzayanov, 28 April 1999 interview with the author.

[236] Apparently, Anisimov bragged of developing a genetically altered strain of tularemia just six months after arriving at Obolensk. This feat astounded his colleagues. According to an account of this incident, Anisimov claimed to have performed his research from memory, but one of the Sverdlovsk scientists was convinced that Anisimov "pinched that strain from us!" An internal investigation revealed that Anisimov's tularemia strain contained a marker—sensitivity to nalidixic acid—singular to a strain developed earlier at Sverdlovsk. See Domaradskij's recount of this theft in *Troublemaker: The Story of an "Inconvenient" Man*. Apparently, one topic of coffee-break discussion at the biological institutes has been how to carry off a smuggling operation. A seed culture could be placed in a piece of paper and put inside of a small plastic bag that the thief could seal hermetically with equipment in the biosafety laboratory. Upon exiting, this tiny package could be concealed between the fingers or toes while changing clothes and showering. Biological institute director, 17 September 1999 interview with the author.

[237] Dr. Ken Alibek, 5 June 1999 interview with the author. A similar remark was made by a senior Vector staffer. "Listen, we didn't account for every ampule of the virus. We had large quantities of it on hand. There were plenty of opportunities for staff members to walk away with an ampule." Richard Preston, "The Demon in the Freezer," *The New Yorker* (12 July 1999): 59.

[238] U.S. government official, interview with the author, Washington, D.C., 22 November 1999; U.S. biodefense expert, 23 November 1999 interview with the author.

storage freezer requires a minimum of three people. In each case, the institute's director clears access, and two other individuals have to employ separate keys that are kept in a wax-sealed containers to reveal unauthorized use.[239]

To reduce further the opportunities for diversion or theft, the Cooperative Threat Reduction program is funding a series of ISTC grants to enhance security at some biological institutes. Vector, Obolensk, the Vladimir All Russian Research Center, the Russian Research Plague Institute at Saratov, the All-Russian Institute of Phytopathology at Golitsino, the Kazakh Anti-Plague Research Institute at Almaty, and the Otar Agricultural Institute, also known as the Otar Railway Station, are each booked to have their physical security augmented. All of these sites have collections of dangerous pathogens. One of the reasons these facilities have been selected for strengthened security is to facilitate the consolidation of culture collections from other locations.[240] Exact plans for the security enhancements at these sites have not been finalized, but the general approach is to strengthen physical barriers such as fences and to install alarms and additional electronic surveillance equipment. Access points will probably be automated with the introduction of electronic keypads. Items of security concern, such as vials containing seed cultures, are likely to be marked with magnetic strips or bar codes designed to alert guards to their removal from secure areas. Seals may also be used to automate the inventory control of sensitive items. From 1997 to 1999, the Pentagon set aside $3 million for security improvements at these biowarfare laboratories. The Defense Department expected to spend at least $10 million to tighten security at the biological institutes in 2000.[241]

---

[239] U.S. biodefense expert, 23 November 1999 interview with the author.

[240] Golitsino, for instance, will probably become Russia's national storage site for anti-plant pathogens, Vladimir the storage center for anti-animal agents, and Saratov for microbial diseases such as the plague. In Kazakhstan, Otar will likely be the anti-plant storage site and microbial diseases will be centralized at the Almaty Anti-Plague Research Institute. U.S. government official, 24 May 1999 interview with the author.

[241] The $10 million figure was augmented with part of $4 million that the Pentagon reprogrammed in mid-November 1999 for biological weapons prevention efforts in Kazakhstan going to the security enhancements at Otar and the Almaty Anti-Plague Research Institute. U.S. government official, interview with the author, Washington, D.C., 29 November 1999. General descriptions of the planned security improvements were also provided by a U.S. government official, interview with the author, Washington, D.C., 19 November 1999; senior ISTC staff member, 20 September 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

CONCLUDING OBSERVATIONS AND RECOMMENDATIONS

With facilities scattered across 8,649,500 square miles, top secret institutes unaccustomed to having monitors in the midst of their laboratories and records, scientists unversed in making a living in a market economy, and Western scientists and companies leery of getting involved with anything or anyone associated with the odious poison gas and germ warfare business, the challenge facing those attempting to keep biological and chemical weaponeers from migrating to proliferators was considerable. The ISTC and its sister programs have worked determinedly to enlarge gradually the number of institutes and individuals from the chemical and biological weapons complexes receiving grant assistance. The progress of brain drain prevention programs has been further checked by several other factors.

Foremost among these obstacles was the economic collapse of August 1998,[242] which hit just as the first batch of grants was beginning to produce research with commercial promise. This fiscal crisis dealt a heavy blow to economies trying to weather the transition to a full, free-market system. The weakened economies in Russia and elsewhere were even less able to absorb workers who wished to leave the institutes for civilian jobs or to support the growth of commercial businesses at the institutes themselves. Western investors began to approach any business opportunities in the former Soviet Union, particularly those involving the weapons complexes, with more caution. With this additional economic duress, the grants from the ISTC, STCU, IPP, and CRDF became an even more critical lifeline for biological and chemical weapons experts.[243] The 1998 economic crisis was undoubtedly a setback for efforts to redirect the weapons institutes into commercial activities, but some institutes nonetheless managed to get spin-off companies started. Such efforts, achieved in the most trying of circumstances, indicate that with perseverance these facilities will be able to attain self-sufficiency.

The remainder of this chapter contains recommendations to enhance the ability of brain drain prevention programs to shepherd chemical and biological weaponeers into the

---

[242] When the Russian government announced a devaluation of the currency on 17 August 1998, Russian investors and banks panicked, sending the currency from 16 cents per ruble to as low as 2 cents per ruble. By the end of August, the Central Bank had spent $1.8 billion to prop up the ruble against the dollar. Sharon LaFraniere, "Ruble Meltdown Accelerates Russian Financial Crisis," *Washington Post*, 27 August 1998, A1; Timothy L. O'Brien, "Central Banker's Resignation Deepens Financial Chasm," *New York Times*, 8 September 1998, A12.

[243] Former U.S. government official, 13 April 1999 interview with the author; U.S. government officials, 19 and 24 May 1999 interviews with the author.

commercial sector. The first series of suggestions pertains mainly to the ISTC and the second mainly to Russia. The middle segments of the chapter discuss the need to commit more funds to collaborative research at the chemical and biological institutes and to define U.S. objectives and coordination mechanisms for these areas of programming. The chapter concludes with some thoughts about how to measure success and keep the brain drain prevention programs on track.

Room for Improvement

While the ISTC and other grant programs have made some impressive strides in preventing the departure of scientists and weapons-usable materials from the chemical and biological complexes, it is nonetheless possible to identify some gaps in programming. For instance, the scientific grant programs are not well-situated to deal with some of the most significant facilities within the chemical and biological complexes, the production and stand-by production facilities. Collaborative research grants can be provided to the scientists in the small laboratories that are part of these larger production facilities, but the grant programs cannot work with the sites as a whole because U.S. law prohibits funding for defense conversion.[244] In the chemical weapons complex, the critical weapons talent is not located at the production facilities, but the ban on defense conversion work nonetheless severely limits the ability of the grant programs to address the majority of the scientists and capabilities at these sites.[245]

To plug this programming gap, members of Congress and U.S. policy makers need to reconsider the prohibition on using U.S. funds for defense conversion. A more discriminating approach would enable conversion in select cases, permitting the ISTC and the other grant programs to sponsor projects that work with Western commercial companies to retool some equipment and kick off the manufacturing of consumer products at these facilities. An advantage to lifting the congressional ban on defense conversion is that the Western commercial partners would have a frequent presence on site—an arrangement likely to foil efforts to produce warfare agents covertly at these facilities. Such an outcome

---

[244] See section 1503 (b) of H.R. 3230, *National Defense Authorization Act for Fiscal Year 1997*, 104th Cong., 2d sess. (Washington, D.C.: U.S. House of Representatives, 23 September 1996).

[245] U.S. government official, 24 May 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author.

is far preferable to allowing the skilled labor at these facilities to become increasingly destitute and even desperate.

The grant programs have begun to expand their activities further into the biological complex, but the level of effort with the chemical weapons scientists remains low and stagnant. Entire segments of poison gas experts have no contact with the grant programs, especially those within the design bureaus that have specialized skills in the aerosolization of agents and their weaponization.[246] Apparently, those running the grant programs do not know which institutes have this aerosolization and weaponization expertise.[247] Arguably, with the formulas for chemical agents well known and the ingredients commercially available, the most difficult technical challenges for a country seeking a poison gas capability are those involving effective dissemination methods. Therefore, it stands to reason that the grant programs need to focus on extending coverage to the scientists from the chemical design bureaus.

In addition, the grant programs are still not reaching major segments of the biological weapons complex. At the height of the Soviet biowarfare program, the anti-plague institutes employed 15,000 scientists. Significant numbers of scientists were also assigned to develop anti-crop and anti-animal agents. Moreover, the grant programs have yet to incorporate any scientists from the four military institutes that are at the heart of the former Soviet biological weapons complex. Efforts to work with these groups of scientists are just getting underway, which means that there is a long way to go before all of the important weapons institutes are brought within its monitored orbit of grant assistance.

Next, the ISTC has endeavored to draw potential commercial partners and Western scientific collaborators into its activities. The government agencies inducted as partners are quite active collaborators, but attracting scientists from commercial companies and universities has been much tougher.[248] Also, several of the forty-five partners that the ISTC

---

[246] U.S. national laboratory senior chemist, interview with the author, Washington, D.C., 29 April 1999; U.S. government official, 24 May 1999 interview with the author; senior ISTC staff member, 20 September 1999 interview with the author.

[247] Senior ISTC staff member, 20 September 1999 interview with the author.

[248] For example, the ISTC runs science seminar series to help former weaponeers make connections with foreign counterparts and begin proposal development. From 1994 to 1998, fourteen such seminars were held. The author examined the list of attendees for one biological conference and observed that it was virtually devoid of Western scientists and commercial representatives. Aside from a few U.S.

had signed up by mid–1999 were participants on paper only. The European commercial partners are reportedly risk-averse, not inclined to invest in projects unless the outcome is certain to be profitable.[249] Were the ISTC to offer modest incentives, more Western university scientists might be induced to collaborate in its work. CRDF, for instance, sets aside a portion of grant funds for its scientific collaborators to defray small expenses and enable travel to the weapons institutes, an idea that the ISTC's weaponeers support even if it means less money for them.[250] Getting more scientific collaborators on board could make a crucial difference in the ISTC's efforts to promote commercialization and self-sufficiency among its grant recipients, so the ISTC's Governing Board might consider amending the no-compensation policy for scientific collaborators from universities and non-profit organizations. These scientific collaborators, along with the members of the scientific advisory committees proposed below, should also provide the ISTC with assistance in recruiting more corporate partners.

The ISTC Governing Board also needs to weigh several reforms to reduce the inordinate delays in the proposal approval process. First, discipline has to be enforced with regard to the time that host and funding governments are given to review proposals. Scientists who need to feed their families will find it difficult to withstand the prosperity that proliferators offer if the proposal approval process drags on for more than two years. Therefore, the ISTC Governing Board would do well to enact a tougher proposal review policy. The host governments should be allotted no more than three months to complete their review of proposals.[251] For their part, the ISTC's funding governments should abide

---

government officials, the rest of the sixty participants were biological weapons experts in search of research partners. The need to bring more outside scientific collaborators into these seminars is evident. Senior chemist, 15 September 1999 interview with the author; ISTC staff member, 20 September 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

[249] Only a few European commercial partners are active, the rest are passive. ISTC staff member, 17 September 1999 interview with the author.

[250] Chemist, 15 September 1999 interview with the author; senior biological researcher, 17 September 1999 interview with the author; biological institute director, 17 September 1999 interview with the author.

[251] The host governments might be more receptive to such a policy if they were more at ease with the ISTC's operations. At present, only the Ministry of Atomic Energy seconds employees to the ISTC. The Ministries of Health and of Science and Technology, as well as the National Academy of Sciences, should also provide staff to the ISTC. Likewise, other host governments should provide an employee or two to the ISTC. Senior ISTC staff member, 20 September 1999 interview with the author.

by a six-month deadline to review, accept or reject, *and* arrange funding for approved proposals.

Other improvements that would speed proposal review include forming expert advisory committees and reformulating the ISTC's work plan review policy. Regardless of the caliber of the proposal, the ISTC staff is obligated to help revise and find scientific collaborators for every proposal that the ISTC registers. This open-ended commitment on the part of the ISTC allows host governments to slough off sub-par proposals to the ISTC to appease demanding scientists or to pursue a slim hope that the ISTC Governing Board might somehow approve them.[252] The upshot of this situation is that the ISTC staff cannot avoid spending a significant amount of time and effort on proposals that contain poor science or nonsensical ideas, to the detriment of other scientifically sound proposals. To deter host governments from forwarding substandard proposals and to cut down on unnecessary work for the ISTC staff, the Governing Board should consider establishing small, scientific advisory committees that could filter out the lemons. Blind, expert reviews need not be a large or cumbersome operation. A small group of esteemed advisors for each different scientific discipline could operate from their regular offices, receiving proposals from the ISTC electronically and returning within a week a very brief (e.g., one page) go-ahead or no-go review.[253] The scientific advisors—each well-connected members of their respective scientific and technical communities—would also be asked to suggest potential scientific collaborators for proposals that receive a green light. Not only would expert pre-screening save the ISTC from pointless work with proposals that would never pass the Governing Board's muster, it would give the ISTC staff a head start on processing more quickly the proposals that make it into the queue.

Next, revisions of the work plans for approved proposals would proceed much more rapidly if the ISTC Governing Board were to set a policy allowing the ISTC staff and

---

[252] ISTC staff members, 15, 16, and 17 September interviews with the author.

[253] Although fifteen or more experts might be appointed to the advisory committees in each scientific disciplinary area, only five or so would be asked to review each proposal. Creating a larger pool of experts enables the proposal reviewing burden to be split more reasonably among the group. Also, scientists submitting proposals would have no way of knowing which advisers reviewed their proposal. Scientific advisors might be offered a modest honorarium for each proposal they review, an expenditure that should more than offset the cost of staff time spent finding scientific collaborators for and enhancing proposals that ultimately have no chance of being funded by the Governing Board.

scientific collaborators to supervise such revisions with the project managers.[254] Work plan revisions currently shuttle back and forth, sometimes in numerous iterations, between project managers, ISTC staff, funding governments, and scientific collaborators. The fact of the matter is that the funding governments rely on their expert collaborators to advise them as to whether a work plan is satisfactory. Common sense therefore indicates that once the collaborators are satisfied, the ISTC ought to have the authority to sign the requisite agreement with the project manager to begin work. Under an amended policy, the funding governments would be sent each revised work plan promptly after it receives approval by the scientific collaborators. Should any of the funders request further changes to the work plan, they could still be made as the research gets underway. This more direct route should enable work plans to be revised and research to be initiated in about two months, instead of the six or more months that this process has frequently consumed.

Cleaning House in Russia

In Almaty, Kiev, Moscow, Tblisi, and other former Soviet capitals, government officials can also take steps to facilitate the integration of the weapons institutes and their work forces into the market economy. In that regard, the host governments need to promote tax incentives for private sector investment and improve the infrastructure protecting intellectual property rights. Host governments should aid the efforts of the weapons institutes to spin-off companies by making it easier for the institutes to lease buildings and equipment to commercial entrepreneurs. For joint research projects to flourish, the host governments need to loosen restrictions on activities that are likely to bring the weaponeers into contact with scientific colleagues and potential collaborators (e.g., travel abroad, publication in juried journals).[255] In addition, host government officials could promote more access to all of the chemical and biological institutes instead of begrudgingly allowing infrequent visits at some sites and keeping others completely closed.

One of the reasons such restrictions are still in effect at the end of the decade is that entrenched opposition to transforming the chemical and biological complexes to peaceful and commercial work persists among hardliners in senior government positions in Moscow, as well as among a few individuals at every institute. These cold warriors want to

---

[254] Senior ISTC staff member, 20 September 1999 interview with the author.

[255] Ibid.

perpetuate a weapons capability, the old way of life, and their own personal influence. Some have reportedly prospered in recent years through corrupt business practices. They deliver a wall of silence about the accomplishments of the Soviet chemical and biological weapons programs, conceding nothing to those who inquire about *novichok* or chimera agents. Given the cuts in the defense budget, the last vestiges of control that overseers of the biological and chemical institutes can exert is to restrict the travel of the scientists, deny permission to publish journal articles, and reject proposals that scientists would like to submit to the ISTC or other grant programs.[256]

The presence of so many hold-over *apparatchiks* from the offensive program days puzzles some observers. "Either the Russian government is so stupid that they do not understand the signals they are sending by keeping these people around or they are not in a position to make these changes," observed one U.S. official.[257] The ISTC and other programs deal directly with the scientists, to the extent possible avoiding the interference of obstructionist bureaucrats. Unlike these cold warriors, the overwhelming majority of the scientists want out of the weapons business.[258] On 25 May 1999, hopes rose when Yeltsin disbanded the President's Committee,[259] creating an opportunity for personnel changes. Unfortunately, nothing changed. All of the people who worked at the President's Committee simply transferred to its replacement, the Agency for Munitions.[260] Hence, some real housecleaning at the Agency for Munitions, Biopreparat, and GosNIIOKhT is still in order.

---

[256] Ibid.; U.S. government official, 24 May 1999 interview with the author; ISTC staff member, 15 September 1999 interview with the author.

[257] U.S. government official, 19 May 1999 interview with the author.

[258] Of the hardliners, Ken Alibek observes, "All of the scientists would be more than happy if these people were removed." Dr. Ken Alibek, 5 May 1999 interview with the author. By one estimate, 95 percent of those at GosNIIOKhT no longer want any involvement with poison gas research and manufacture, and an even higher percentage of biological scientists want nothing more to do with germ warfare. Senior ISTC staff member, 20 September 1999 interview with the author. "As they learn about the grant program, they want out [of the weapons business], especially the younger ones." U.S. non-governmental analyst, 18 June 1999 interview with the author.

[259] Decree of the President of the Russian Federation Concerning the Structure and Authority of Federal Agencies, President Boris Yeltsin, Decree Number 651 (Moscow: 25 May 1999); Decree on the Organization of the Russian Federal Government: Questions About Russian Military Agencies, Premier of the Government of the Russian Federation S. Stepashin, Decree No. 906 (Moscow: 6 August 1999).

[260] Chemical institute director, 15 September 1999 interview with the author.

After evicting those who oppose the redirection of the chemical and biological institutes from their positions of authority, Moscow should also quietly open its archives about the weapons institutes and their scientists to the governments funding cooperative research grants. Sharing information about the key weapons scientists would help the funding governments improve the aim of grants.[261] Not only would such a step enhance the effectiveness of the grant programs, it would dispel the impression that Moscow is still trying to hide something and engender confidence that offensive research has halted once and for all.

An Ounce of Prevention

In the past few years, some of the biological and chemical weapons institutes have begun to take their first wobbly steps into manufacturing and the commercial marketplace. Vector, followed perhaps by GosNIIOKhT and the Research Institute of Highly Pure Biopreparations, are the farthest along in that regard. More often than not the personnel on the manufacturing lines are an institute's technicians and junior scientists, not the key weapons scientists. Weaponeers are likely to resist efforts to shuffle them into simpler jobs on the bottling and packaging lines. For this reason, the quick-and-easy approach to commercialization—get them making anything but weapons, whether it be televisions or automobile parts[262]—is not necessarily a recipe for nonproliferation success. Establishing profitable spin-off companies at the institutes is an important part of the overall self-sufficiency *and* containment strategies. These companies can be planned with an eye toward challenging the former weaponeers with research tasks that feed new commercial products back into the spin-off companies. Searching for new medicines is more likely to hold the interest of the weapons scientists than running a beer brewery. A significant function of grant assistance is to help the scientists get these new companies off the ground so that they in turn can generate revenues to help to keep the institutes afloat. To the extent that these spin-off launches succeed, the institutes will be on the road to integration into the civilian economy and the weapons scientists will remain at home, gainfully employed.

---

[261] Once imparted, of course, the funding governments should properly classify such data because of its utility to potential proliferators.

[262] For example, in 1995, Obolensk apparently opened a "brewery, an assembly line for Italian men's suits," and was planning to add a vodka distillery. Harrington, "Redirecting Biological Weapons Expertise," 3.

Fostering self-sufficiency at the biological and chemical weapons institutes is a complicated, drawn-out process. Not only must business practices be taught and laboratory and manufacturing standards improved, the culture of dependency and secrecy must be changed to one of initiative and transparency. Through its training programs and special grants, the ISTC can instill business savvy in the scientists and upgrade the laboratory, manufacturing, and security standards of the institutes. Grants from the IPP, CRDF, and STCU can also help the scientists scale the learning curve of how to bring research results to the commercial marketplace. Business training equips the scientists at the institutes to move into the marketplace, and their success breaks the cycle of dependency and secrecy. These spillover effects give all the more reason to put additional resources into the auxiliary training and special grant programs.

Since 1992, through the Cooperative Threat Reduction program alone, Washington has earmarked a considerable amount of money—$3.172 billion[263]—to prevent the proliferation of weapons of mass destruction from the states of the former Soviet empire. This program has performed as advertised, reducing threats in the following ways, among others:

- returning over 3,380 strategic nuclear warheads safely to Russia from Belarus, Kazakhstan, and Ukraine;
- deactivating over 4,835 strategic nuclear warheads;
- eliminating 395 strategic missiles in Russia and Ukraine, including 124 SS–19s, 112 SS–18s, 10 SS–17s, 119 SS–11s,and 30 submarine-launched ballistic missiles;
- destroying over 525 strategic ballistic missile launchers, missile silos, and heavy bombers in Kazakhstan, Russia and Ukraine; and,
- sealing over 175 nuclear test tunnels in Kazakhstan.[264]

Seen another way, the Cooperative Threat Reduction program has deactivated, dismantled, or destroyed more nuclear weapons than are in the combined arsenals of the United

[263] Congress has appropriated this amount for Cooperative Threat Reduction programming from fiscal years 1992 to 2000.

[264] The Cooperative Threat Reduction Agency keeps a running tally of its progress. “Cooperative Threat Reduction Accomplishments.” Internet: http: www.ctr.osd.mil/03accomp.htm. Downloaded on 19 November 1999.

Kingdom, France, and China.[265] With the Freedom Support Act, the Cooperative Threat Reduction program has involved over 28,500 nuclear, missile, biological, and chemical weapons experts in collaborative research projects via the ISTC and STCU.

The overall amount set aside for threat reduction assistance to the states that used to comprise the USSR is considerable, but the fact of the matter is that the funds going into chemical and biological brain drain programs are slight. The U.S. contributions to ISTC, STCU, CRDF, and IPP programs are presented in Table 5. When these four programs are tallied, the U.S. support of collaborative grants with biological weapons scientists each year has averaged $3.6 million. The corollary figure for U.S. support of grants to chemical weaponeers totals $1.4 million annually. The ISTC's other major contributors are the European Union and Japan. As shown in Table 6, Japanese and European Union contributions to biological grants each year averaged $79,000 and $1.7 million, respectively. For chemical grants, the European Union contributed an average of $242,000 per year and Japan $13,000.[266]

As noted above, the grant programs have yet to reach all of the key biological and chemical weapons institutes. Grant activities were initiated at the more obvious and easier to approach locations and are gradually spreading to encompass more of the chemical and

---

[265] The combined total for the arsenals is roughly 1,330 nuclear weapons. At the end of 1997, the British nuclear stockpile stood at 380 weapons, the French at 500, and the Chinese have 450. William S. Arkin, Robert S. Norris, Joshua Handler, *Taking Stock: Worldwide Nuclear Deployments 1998* (Washington, D.C.: Natural Resources Defense Council,1998), 1.

[266] Data provided to the author by the ISTC, 7 December 1999. The European Union also provides assistance to scientists via the Technical Assistance and Copernicus programs, but it was not possible to determine the number of chemical and biological weapons scientists receiving aid through these programs.

Table 5: U.S. Support of Collaborative Research Grants with Chemical and Biological Weaponeers.

Grant Program	Total Contribution to Grant Program (1994–1999)	Chemical Grants Total (1994–1999)	Biological Grants Total (1994–1999)	Annual Average for Chemical Grants†	Annual Average for Biological Grants†
ISTC††	$89.9 million	$3.8 million	$13.3 million	$691,000	$2.4 million
IPP	$126.7 million	$2.5 million ($5.4 million*)	$5 million ($10 million*)	$455,000 ($982,000*)	$909,000 ($1.82 million*)
CRDF**	$11.8 million	$550,000	$460,000	$100,000	$84,000
STCU***	$21.4 million	$700,000	$800,000	$127,000	$145,000
Total	$249.8 million	$7.55 million	$19.56 million	$1.37 million	$3.54 million

† Calculations of annual averages for chemical and biological grants covered a five and a half year period, from 1994 to mid–1999.
†† Data provided to the author by the ISTC, 7 December 1999.
* The number in parentheses represents *total* IPP funding to chemical and biological grants from 1994 to 1999. The smaller number derives from the General Accounting Office's critique that approximately 37 percent of IPP funds reach the former Soviet scientists. For the above calculations, the author assumed that 50 percent of the total IPP contribution reached scientists in the target communities.
** CRDF calculations are based on an average value of $50,000 for CRDF cooperative grants. In its 1996 grant cycle, CRDF funded five projects with biological weaponeers and eleven with chemical weapons scientists, respectively. Also included in the total for CRDF funding of biological weaponeers is $210,000 in grants to Stepnogorsk scientists.
*** The total STCU budget through 1998 was $27 million, of which $21 million, or roughly 80 percent, was contributed by the U.S. On average, the STCU's 215 projects each cost $125,000. The table reflects the U.S. share of the seven chemistry and eight biology grants. Estimates confirmed on 24 November 1999 by the Office of Proliferation Threat Reduction, Bureau of Nonproliferation, U.S. Department of State.

Table 6: European Union and Japanese Support of Collaborative Research Grants with Chemical and Biological Weaponeers.

Contributor	Total Support to ISTC (1994–1999)	ISTC Chemical Grants Total (1994–1999)	ISTC Biological Grants Total (1994–1999)	Annual Average for ISTC Chemical Grants†	Annual Average for ISTC Biological Grants†
European Union*	$86.9 million	$1.3 million	$9.2 million	$242,000	$1.7 million
Japan	$31.5 million	$73,333	$434,667	$13,000	$79,000

† Calculations of annual averages for chemical and biological grants covered a five and a half year period, from 1994 to mid–1999.
* The European Union also offers grant support via the Copernicus program and the International Association for the Promotion of Cooperation with Scientists from the Independent States of the Former Soviet Union.
Sources: *1997 ISTC Annual Report*, 4; *1998 ISTC Annual Report*, 5; additional technology area data provided to the author by the ISTC, 7 December 1999.

biological weapons institutes. Yet, of the 7,000 biological weaponeers that are of proliferation concern, the ISTC apparently had just over 1,000 on its grant payroll in 1998.[267]

Similarly, the ISTC has a long way to go with chemical weapons specialists, having yet to enroll the weapons design bureaus. While there have certainly been other hurdles to bringing chemical and biological weapons scientists into collaborative research programming, lack of funding has been a major impediment.

If the objective is to provide the weaponeers with a subsistence wage so that they can support their families and resist the offers of proliferators, then to date the total funds put into the chemical and biological grant programs have been insufficient for the scope of the task. Biological and chemical weapons experts receiving ISTC grants have seen their $50 per month government stipend augmented by $50 to $360 per month.[268] These higher wages can support a family of four in Russia, where to stay above the poverty level in 1999, an individual must earn approximately $37 per month for each person needing food and clothing.[269]

However, the grants provided across the ISTC, IPP, CRDF, and STCU programs—averaging $8.4 million annually[270]—are inadequate to keep 10,500 key chemical and biological weapons experts above the poverty line. This observation is made mindful that the 10,500 figure is a *conservative* estimate of the biological and chemical weaponeers of proliferation concern. Spread across the target population of 3,500 key chemical and 7,000 biological weapons scientists, the monthly grant stipend would have been $67 over

---

[267] Tucker, "Bioweapons in Russia," 37.

[268] The monthly wage for a technician or assistant is $50 to $70, for a junior scientist $105, a senior scientist $200; and a project manager $360. Chemist, 15 September 1999 interview with the author.

[269] As of September 1999, the World Bank estimates poverty-line wages to be 920 rubles per person per month. Based on a 30 November 1999 exchange rate of 25 rubles to the dollar, 920 rubles equates to $37 per month. Data provided to the author by Jenine Braithwaite of the World Bank, 30 November 1999.

[270] Grants to chemical and biological weapons scientists through these four programs total $46.2 million. This amount was divided by 5.5 to get an annual average for the period of 1994 to mid–1999. Of the $46.2 million, $35.5 million was expended on biological grants and $10.7 million on chemistry grants.

the last five and a half years.[271] Thus, even if the grant programs had been able to reach the target populations of biological and chemical weapons scientists, the financial assistance provided would not have been enough for the scientists to support a small family. In order for the grant programs to keep 7,000 biological weapons scientists supporting a family of four above the poverty line, a minimum of $12.4 million annually would be required. The comparable sum for the 3,500 chemical weaponeers is $6.2 million.[272]

The importance of injecting more financial support into the chemical and biological grant programs is underscored by the fact that a full-fledged nuclear program can take decades to mature, but in a relatively short span of time former Soviet biological and chemical weaponeers could accelerate the rudimentary chemical and germ warfare programs of other countries to lethal maturity. An ounce of prevention—applied via collaborative research grants, security enhancements, and training programs to steer the institutes toward self-sufficiency—could short-circuit such biological and chemical weapons proliferation.

Given the consequences of the chemical and biological brain drain, a sound argument can be made for at least doubling the amount of money going annually into collaborative research grants for biological weaponeers and at a minimum tripling the grant funds for chemical weapons scientists. Ideally, the budgets for these programming areas would increase even more, for these are poverty-level support calculations based on the U.S. government's conservative estimated number of key biological and chemical weapons experts. While it is imperative that funds commensurate with the task be provided, increased support for biological and chemical grants should not come at the expense of the grants made to nuclear and missile scientists. Table 7 shows the effect on the U.S. defense budget if the United States were to support the recommended increases on its own. However, Washington should not be the only funding country to boost its contribution for

---

[271] More specifically, $10.7 million in funds would have resulted in a $47 monthly grant stipend for 3,500 chemical weapons scientists. A corresponding monthly grant wage of $77 would have gone to each of the 7,000 biological weaponeers out of a total of $35.5 million in biological grants.

[272] The annual average funding from the ISTC, STCU, IPP, and CRDF to support key biological weapons scientists was only $6.4 million through mid–1999. Funding for chemical weaponeers averaged $1.9 million through mid–1999.

Table 7: U.S. Funding of Chemistry and Biology Grants as a Percentage of the Defense Budget.

Area of Funding	Average Annual U.S. Funding from 1994 to mid–1999	Average Annual U.S. Funding as a Percentage of U.S. Defense Budget	*Minimum* Recommended Annual Funding Level	*Minimum* Recommended Annual Funding Level as a Percentage of U.S. Defense Budget
Total U.S. Grants to Chemical Weapons Scientists	$1.37 million	0.00051%	$6.2 million	0.0023%
Total U.S. Grants to Biological Weapons Scientists	$3.56 million	0.0013%	$12.4 million	0.0046%

chemical and biological grants. European and Japanese national security planners also need to weigh the comparative security that can be purchased with an additional tank or aircraft against the prospect of conflict with an opponent that has reaped secrets from the toxic archipelago.

The decision to increase funds significantly to prevent the proliferation of poison gas and biowarfare expertise and weapons-usable materials is a matter of setting national security priorities. In the scheme of the Pentagon's $267 billion budget,[273] the suggested increases for chemical and biological grant assistance are extremely modest. The skew in grant funding needs to be corrected so that there are sufficient resources to provide some support to all of the key chemical and biological weaponeers. U.S. decision makers might also want to consider how much resources are being put into brain drain programming as a whole and whether the current level of funding provides adequate coverage for all of the critical nuclear weapons experts and missiliers as well. The U.S. support for all of the ISTC's grant programs averaged $16 million from 1994 to 1999.[274] Doubling that contribution would still be a fraction of the Pentagon's budget—0.01 percent, to be exact.

---

[273] For more detail on the Defense Department's fiscal year 2000 budget, see Public Law 106–79, 25 October 1999.

[274] *1994 ISTC Annual Report*, 24; *1995 ISTC Annual Report*, 18; *1996 ISTC Annual Report*, 9; *1997 ISTC Annual Report*, 4; and *1998 ISTC Annual Report*, 5. Data for 1999 provided to the author by the ISTC, 7 December 1999.

Comparatively small investments in brain drain prevention could have major national security payoffs. As Nunn and Lugar, the duo that founded the Cooperative Threat Reduction and related programs, have counseled from the beginning, this effort is not about giving a handout to Russia and the other former Soviet countries. Rather, it is about taking pragmatic steps to reduce threats to U.S. security.[275]

A final factor to take into account when considering national security spending options is that it is more cost-effective to stop proliferation at the source than to create and deploy new defensive countermeasures against biological and chemical agents. To illustrate the point, the cost of vaccinating U.S. troops against anthrax—an effort spanning six years—is $130 million.[276] The price tag to research, develop, and deploy gas masks for U.S. ground troops and aircrews is about $383 million.[277] Chemical and biological defense programs constitute money well spent, but a hefty investment in brain drain proliferation programs would reduce the possibility that these defense capabilities would have to be used on the battlefield.

Putting the U.S. House in Order

The ISTC, STCU, IPP, and CRDF all fund peaceful research projects as a means to prevent proliferation, but these programs operate differently. The IPP works bilaterally with host governments, the ISTC and STCU are multilateral organizations, and the CRDF is more of a scientist-to-scientist effort, with minimal government involvement. Since no single program has been designated as the "lead" effort, one U.S. government official argues there is maximum flexibility in deciding whether the ISTC, IPP, STCU, or CRDF is best suited to sponsor a particular project.[278]

---

[275] For a description of the origins of this fruitful partnership, see Helen Dewar, "The Senate's New Alliance: Nunn and Lugar," *Washington Post*, 7 March 1993, A11.

[276] Steven Lee Myers, "U.S. Armed Forces To Be Vaccinated Against Anthrax," *New York Times*, 16 December 1997, A1.

[277] The research and development costs for a gas mask, including full, live agent operational testing under all climate conditions, run over $65 million. Equipping U.S. ground troops with masks costs around $3 million, or roughly three million at $100 apiece. The price tag for production of air crew masks, which are much more expensive because they must be integrated with aircraft systems, could run as high as $250 million for 100,000. Data provided to the author on 6 December 1999 by Wayne Davis, Office of the Program Manager for Nuclear, Biological, and Chemical Defense, Soldier and Biological Chemical Command.

[278] U.S. government official, 13 April 1999 interview with the author.

Four different pots of money for brain drain prevention programs, however, invites complication. Several additional government agencies have also become partners in biological research projects over the last few years,[279] punctuating the importance of good organization and a clear division of responsibilities among the different brain drain prevention programs. In 1998, the State Department's Office of the Coordinator of U.S. Assistance to the New Independent States assumed the lead oversight role for the multi-agency push to promote transparency at the former Soviet biological institutes via cooperative scientific research activities. Coordination of U.S. grants to biological weapons scientists runs from proposal review and approval to project auditing.[280] The State Department has a computerized tracking system to cross-check the proposals under consideration by the ISTC, STCU, and IPP programs. Interagency coordination of the IPP, ISTC, and CRDF grants also occurs via the monthly Nonproliferation Roundtable, where the roles and missions of the various grant programs are described as "very well understood by the players."[281] Working-level coordination of the biological grants appears to be going fairly well, but the senior managers of these programs have reportedly clashed on occasion.[282]

---

[279] Work with the biological weapons institutes revolved initially around the State and Defense Departments, featuring the U.S. Army Medical Research Institute of Infectious Diseases. Then, the Energy, Health and Human Services, and Agriculture Departments brought to the table such additional players as the National Institutes of Health, the Centers for Disease Control, the Agricultural Research Service, and several national laboratories. The Defense Advanced Research Projects Agency is another much welcomed player that has joined the effort to engage the biological weaponeers.

[280] William B. Taylor, Coordinator of United States Assistance to the New Independent States, "Statement before the House Committee on International Relations" (Washington, D.C.: 9 June 1999). Among many other tasks, this State Department office also manages U.S. humanitarian assistance to the former Soviet states and works on the strengthening the export control systems of these government.

[281] The quote is taken from a 24 May 1999 interview with a U.S. government official. Interagency coordination of biological grants was also described by a U.S. biodefense expert, 21 May 1999 interview with the author; U.S. government official, interview with the author, Washington, D.C., 12 August 1999; U.S. biodefense expert, 23 November 1999 interview with the author.

[282] Another indication of a rift is that when IPP personnel travel to Moscow, they do not schedule meetings with the ISTC staff. Senior ISTC staff member, 20 September 1999 interview with the author. Others describing friction between the ISTC and IPP included a U.S. government official, interview with the author, Washington, D.C., 8 October 1999; former U.S. government official, 16 November 1999 interview with the author; U.S. biodefense expert, 23 November 1999 interview with the author.

As far as work with the chemical weapons institutes is concerned, plans to fund projects with poison gas experts are meshed at the Nonproliferation Roundtable. However, a coordinator for the chemical research projects has not been established, perhaps because of the paucity of funds involved. The grant programs would have worked more aggressively to reach the chemical weapons institutes, stated U.S. government officials, if sufficient manpower and funds were available to design and implement the projects properly.[283] With the number of grant projects already underway, the handful of staffers in the State and Defense Department offices that oversee these efforts are already strained to the limit.[284] An increase of funds into the biological and chemical collaborative research programs should be accompanied by additional program managers. Otherwise, the existing delays in reviewing project proposals and making funding decisions will get even worse.

Another feature that is noticeably absent is an overall architecture for U.S. brain drain prevention efforts. When the foundation for the ISTC was laid, the assumption was that the ISTC was a transitional bridge, needed until the year 2000 or so.[285] Perhaps for this reason, no firm superstructure was constructed at the outset. Instead, the government agencies working with the ISTC, STCU, CRDF, and IPP programs each devised their own programs, agendas, and operational approaches in a loose fashion. Policy statements about brain drain prevention efforts have also been quite devoid of concrete goals. By their own admission, U.S. government officials still do not really have a handle on the scope of the chemical and biological weaponeers problem. Also, "success" as such may be difficult to define with regard to brain drain prevention efforts. Nonetheless, guidelines establishing near- and long-term objectives would undoubtedly help bring focus to the various programs.

---

[283] U.S. government officials, 19 and 24 May 1999 interviews with the author.

[284] The State Department's Office of Proliferation Threat Reduction in the Bureau of Nonproliferation has responsibility for the ISTC and STCU efforts. In 1999, the staff consisted of two full-time employees, three part-time employees, and three full-time consultants. Over at the Pentagon, in the Office of the Secretary of Defense, International Security Policy, Strategy and Threat Reduction, two individuals are working the chemical and biological portfolios. At the Defense Threat Reduction Agency, there is also shortage of implementers for projects at the biological and chemical institutes.

[285] The ISTC's founding parties appreciated that the effort would be a long-term one. They committed to two years of funding, after which progress would be reviewed. The need to continue the grant program was universally accepted at that juncture. U.S. government official, 19 May 1999 interview with the author. Also, ISTC staff member, 17 September 1999 interview with the author; senior ISTC staff member, 21 September 1999 interview with the author.

Much work remains if the chemical and biological weapons institutes are to be assimilated into the civilian marketplace, so the U.S. government should step back, draw a road map of where these efforts need to go, and better organize itself for an activity that could go well into the next century. The time has long since come for higher-level oversight and the stipulation of overarching brain drain prevention goals in a Presidential Decision Directive. Given the importance of the problem and the multitude of agencies involved, coordination responsibilities should rest in the National Security Council.[286] Such a directive should define the roles of the various programs and formalize the interagency structure for the coordination of the chemical and biological grant programs. This action would help to reduce friction and possible redundancy between the programs and otherwise establish the proper environment for a coordinated, government-wide effort.

Tackling Mission Impossible

The assignment given to the ISTC and other collaborative grant programs was and is extremely difficult, particularly since these efforts are taking place against a backdrop of economic turmoil. The grant programs were charged with convincing thousands of skilled weapons scientists, most with barely a ruble in their pockets, that the possibility of receiving some grant assistance was preferable to the certainty of a lucrative job in a proliferating country, several of which could be expected to seek their services.[287] The odds appeared stacked against success, yet the biological and chemical weapons scientists have not left in droves.

---

[286] By no means is this the first request for a national coordinator for nonproliferation programming. This recommendation was first made by Senators Lugar, Nunn, and Pete Domenici (R–New Mexico). See subtitle D of the Nunn–Lugar–Domenici Defense Against Weapons of Mass Destruction Act, *Conference Report of the National Defense Authorization Act for Fiscal Year 1997* (Washington, D.C.: July 1996).

[287] The countries of biological proliferation concern are China, Egypt, Iran, Israel, Libya, North Korea, Russia, Syria, and Taiwan. The countries of chemical proliferation concern are Egypt, Iraq, Israel, Libya, Myanmar, North Korea,Syria, Taiwan, and Vietnam, none of which have joined the Chemical Weapons Convention. Treaty members that had appeared on earlier lists of possible chemical weapons possessors are China, Ethiopia, India, Iran, Pakistan, Russia, and South Korea. China, India, Iran, Russia, and South Korea have declared their chemical weapons capabilities as required and opened them to inspection under the treaty. Lists of countries of proliferation concern have been published by the Office of the Secretary of Defense, U.S. Arms Control and Disarmament Agency the Office of Technology Assessment; U.S. Congress, House Committee on Armed Services and Senate Committee on Governmental Affairs.

One major factor working in favor of the science grant centers and their funders is that the scientists in the chemical and biological weapons complexes would rather work in their native countries than go overseas. The Western job markets are already full of qualified scientists, and leaving their homeland to search for employment is considered a risky endeavor. Not only is it difficult for the scientists to afford the airfare, they must market themselves in a country where a different language is spoken, survive without income until they get a job, and leave behind their families and culture. Those that succeed often have to start in entry-level positions for which they are overqualified and work their way up again. For these reasons, many weaponeers believe the security of guaranteed housing and the comfort of a familiar social environment offset the higher wages that they might earn elsewhere.[288] In the words of one ISTC staffer, "as long as the ISTC provides some stability and a means for them to support their families, they have no interest in leaving."[289] The scientists, it would seem, much prefer to stay put. Thus, investments in the ISTC and other grant programs are bound to pay nonproliferation dividends.

Every weapons scientist that stays home and learns to apply his or her skills to peaceful, commercial research constitutes a "win" for the grant programs. Each time a scientist licenses a grant-funded invention that a company subsequently picks up for production, progress is being made. New companies are sprouting throughout the chemical and biological complexes, a hopeful sign that after several years of seed-planting grants, increasing numbers of former weaponeers will know the satisfaction of earning an honorable living. Not all of these spin-offs will make it in the commercial marketplace, but in the days ahead, observers of the grant programs will be able to measure success with each company that begins earning a profit. The task in front of the ISTC, STCU, IPP, and CRDF is to help secure the success stories in the making and to branch out from those institutes to others as yet untouched by grant assistance and the peaceful transformation that comes with it.

Success for the grant programs can also be measured in a broader pattern of interaction within the weapons complexes. For seven years, the four military facilities in the biological weapons complex have ignored appreciable diplomatic pressure and steadfastly denied access to U.S. and British inspectors seeking to confirm the shutdown of

---

[288] "Now, inertia and the lack of mobility in Russia has kept the majority of the people in place." U.S. government official, 24 May 1999 interview with the author. Reasons why the scientists are reluctant to leave were also given by a senior ISTC staff member in a 16 September 1999 interview with the author.

[289] ISTC staff member, 17 September 1999 interview with the author.

the offensive weapons program. However, the scientists from Yekaterinburg, Kirov, Sergiev Posad, and the Scientific Research Institute of Military Medicine at St. Petersburg are moving closer each day to engaging in ISTC-sponsored projects. This turnabout-in-the-making is testimony to the attractiveness of the opportunities that the grant programs provide and their ability to effect positive change little by little.

Some would penalize these military institutes for not opening their doors sooner and the Russian government for failing to fire the hardliners who continue to frustrate progress on these matters. The refusal to divulge all past offensive activities of the chemical and biological weapons programs is another reason given for exacting punishment. Suggested penalties run the gamut. Some would condition scientific grant funds to the requisite personnel and transparency changes. Others propose curtailing overall economic and humanitarian assistance when U.S. policy makers disagree with Moscow over Chechnya, Bosnia, Iraq, and Kosovo. The same range of penalties are threatened if U.S. or ISTC auditors should catch a group of project scientists aiding proliferators on the side or shunting grant funds to offensive research activities.

Punishment works best when applied judiciously. Otherwise, it can retard both political and economic reform. If grant scientists are caught red-handed in offensive research, whether it be for their own or someone else's government, grant payments to those involved should be immediately stopped. Should the institute in question be the recipient of any other collaborative research grants, then those payments should be reduced by a significant amount, say 50 percent.[290] Prominent advertisement of this type of a punitive strategy will help create peer pressure within the institutes against the undesired behavior. The scientists will begin policing themselves to avoid a cutoff of grant assistance.

Some advocate suspending all scientific grants at all institutes until the hardliners are dismissed or until there is complete access and the Russian government concedes the truth about the advances made in the chemical and biological weapons programs.[291] This approach, however, penalizes the weapons scientists who are trying to make the transition

---

[290] U.S. policy is that a behavioral "problem in an institute can affect all [U.S.] programs at that institute." Statement of William B. Taylor before the House Committee on International Relations, 9 June 1999. The ISTC policy is to sever grant payments to any scientist(s) caught misbehaving.

[291] Among those favoring this more sever approach are Dr. Vil Mirzayanov, 28 April 1999 interview with the author; Dr. Ken Alibek, 5 June 1999 interview with the author.

to the private sector. Moreover, this draconian strategy would also eliminate incentives for nonproliferation and create incentives for brain drain. To date, the funding governments have worked around these problems because holding grant funds hostage to personnel and policy changes on the part of the host governments "would only isolate all of these institutes again, which is not the answer to security and nonproliferation concerns about these facilities."[292]

The battle against brain drain is fought one day at a time, one institute at a time, and one scientist at a time. Setbacks of various types are bound to occur, but they must not dissuade the sponsors of collaborative scientific research grants from continuing the effort. Nor should other types of bilateral or international policy disagreements take nonproliferation programs off course. For this reason, Washington must insulate brain drain and other Cooperative Threat Reduction programming from politics, creating a blanket exemption for these categories of assistance if Congress or the Executive Branch opts in the future to arrest humanitarian or other economic assistance to Russia.

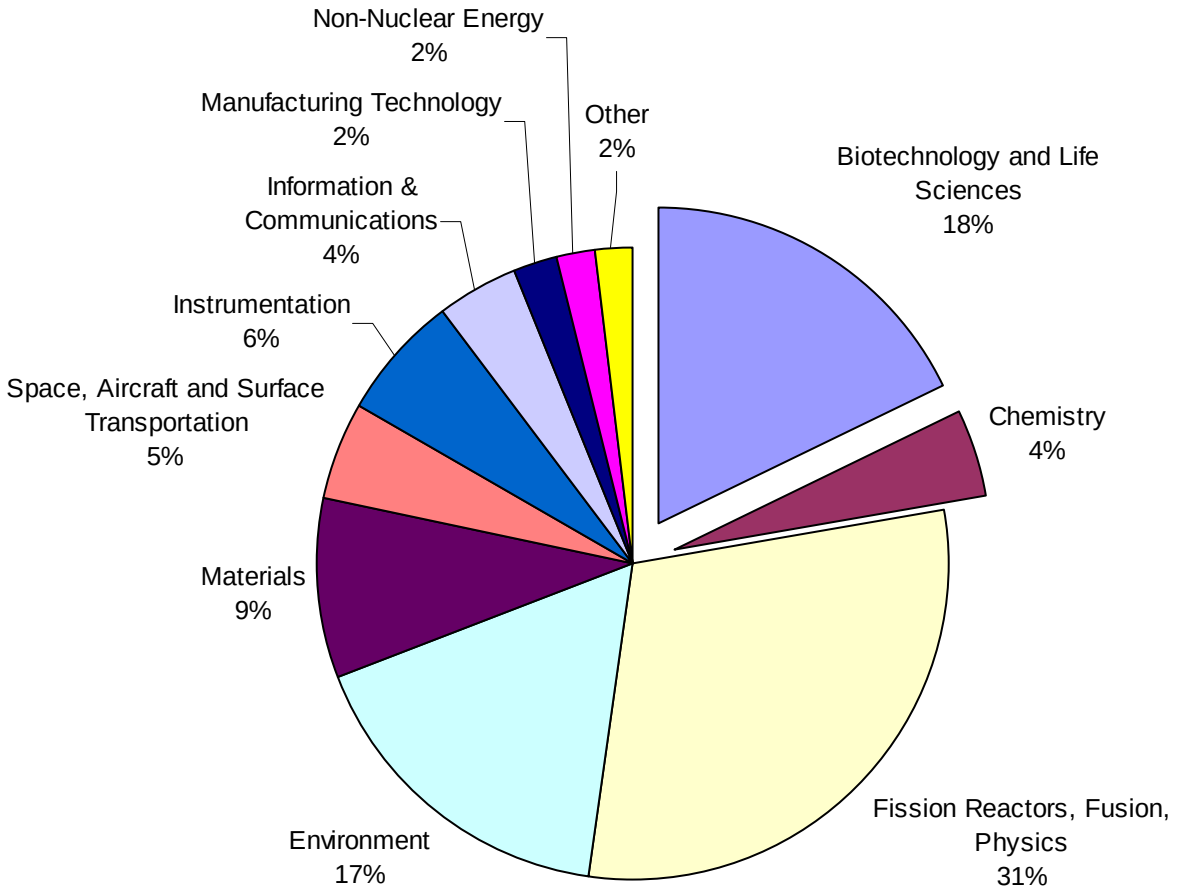
[292] U.S. government official, 19 May 1999 interview with the author; U.S. biodefense expert, 21 May 1999 interview with the author.

THE HENRY L. STIMSON CENTER

Updated 24 January 2002

ISTC Projects (1994-2000)

TOTAL: 1,163

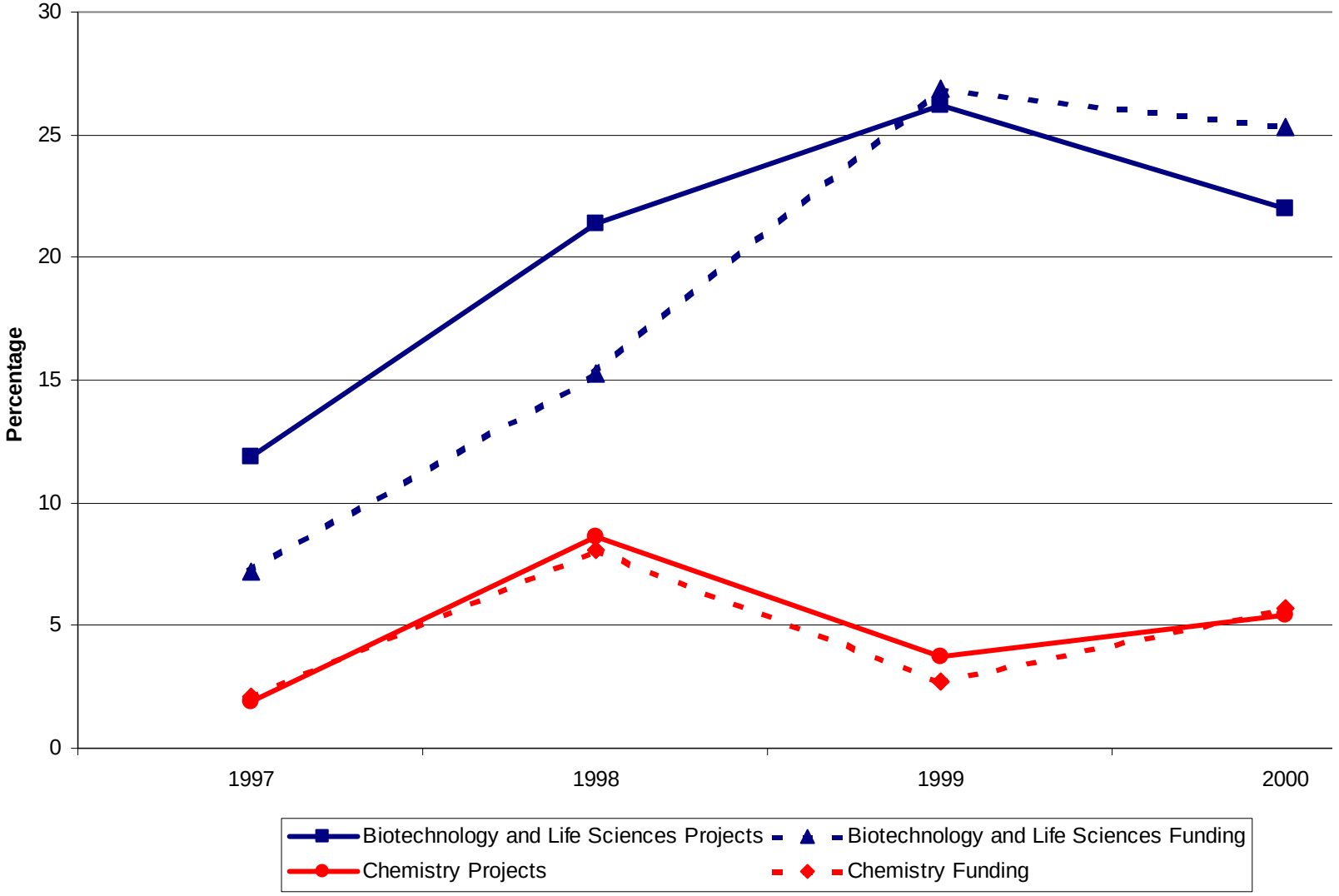


Source: ISTC Annual Reports from 1997-2000

THE HENRY L. STIMSON CENTER

Updated 24 January 2002

Projects/Funding as % Overall ISTC Activity

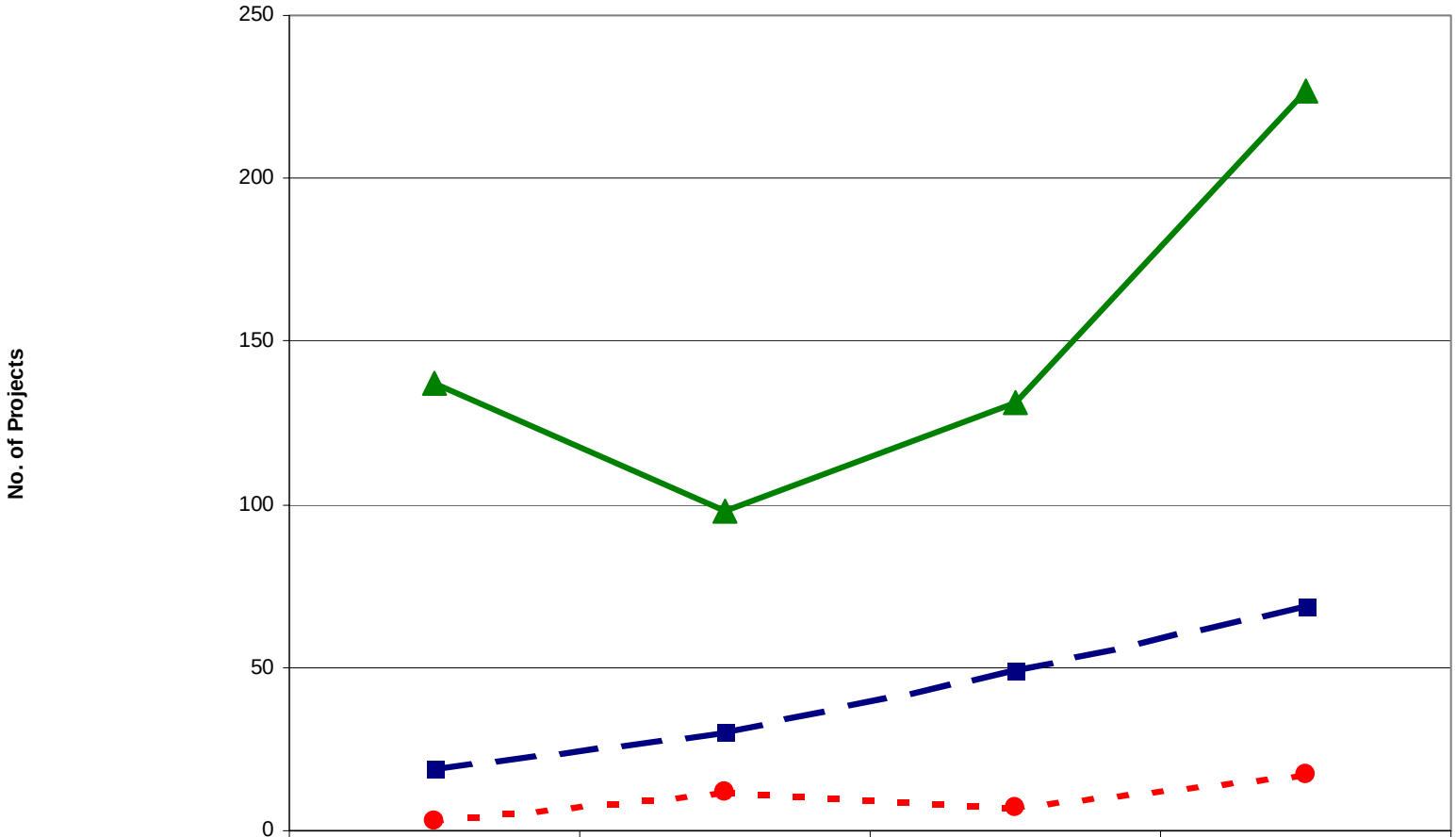


Source: ISTC Annual Reports from 1997-2000

THE HENRY L. STIMSON CENTER

Updated 24 January 2002

ISTC Projects
(1997-2000)



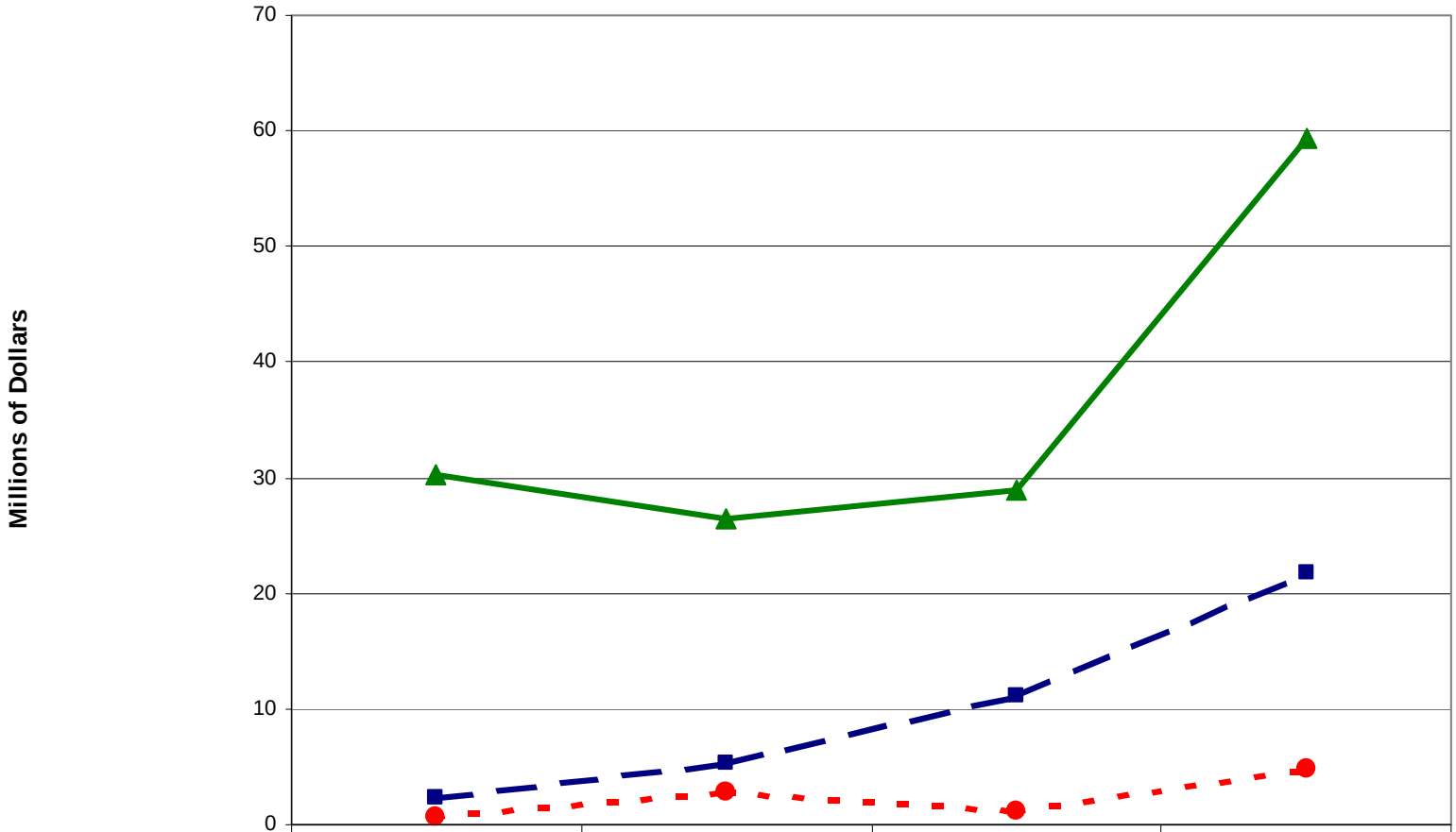
	1997	1998	1999	2000
Biotech/Life Sci.	19	30	49	69
Chemistry	3	12	7	17
Other	137	98	131	227

Source: ISTC Annual Reports from 1997-2000

THE HENRY L. STIMSON CENTER

Updated 24 January 2002

ISTC Funding By Project Area
(1997-2000)



	1997	1998	1999	2000
Biotech/Life Sci.	2.4	5.3	11.1	21.7
Chemistry	0.7	2.8	1.1	4.9
Other	30.2	26.4	29.0	59.3

Source: ISTC Annual Reports from 1997-2000