WORKING PAPERS

Russian Basic Science After Ten Years of Transition and Foreign Support

Irina Dezhina
Loren Graham

RUSSIAN AND EURASIAN PROGRAM

CARNEGIE ENDOWMENT for International Peace

Number 24
February 2002

Carnegie Endowment for International Peace
1779 Massachusetts Avenue, N.W.
Washington, D.C. 20036
Tel: (202) 483-7600
Fax: (202) 483-1840
www.ceip.org

Carnegie Endowment Working Papers

Carnegie Endowment Working Papers present new research by Endowment associates and their collaborators from other institutions. The series includes new time-sensitive research and key excerpts from larger works in progress. Comments from readers are most welcome; please reply to the authors at the address above or by e-mail to pubs@ceip.org.

* * *

About the Authors

Irina Dezhina is a senior researcher at the Institute for the Economy in Transition in Moscow, Russia.

Loren Graham is professor of the history of science at the Massachusetts Institute of Technology, Cambridge, Massachusetts.

Contents

FOREWORD

The Soviet scientific establishment, while not without defects, stood as one of the more solid achievements of the Soviet Union. It was one of the world's largest and possessed world-class strengths in a number of fields, notably theoretical physics and mathematics. But like virtually all state institutions inherited by the newly cast Russian Federation, the scientific establishment's capacity to provide for basic training and research suffered mightily from the economic collapse of the 1990s. Many leading scientists left the country for top positions in the United States, Europe, and elsewhere, while thousands of others simply left science altogether. The decrease in financing coupled with internal and external "brain drain" led many observers to fear the possible death of Russian science.

Outside support from concerned foreign foundations, governments, and international agencies helped to prevent the complete collapse of Russian science in the 1990s. Academician Vladimir Fortov, former director of the Russian Foundation for Basic Research, estimated that in 1995 approximately 50 percent of Russian basic science was being financed from foreign sources. The intervention of Western organizations also served to promote the agenda of some Russian reformers by introducing open competition for funds, peer-review selection procedures, and other changes, which strengthened the research capabilities of regional universities. Finally in the last two years we have seen some modest signs of improvement in the material situation of Russian science and scholarship: the brain drain has subsided and funding from the Russian government has increased.

In this paper, two leading international scholars of the Russian science community—Irina Dezhina of the Institute for the Economy in Transition and Loren Graham of the Massachusetts Institute of Technology—assess what has happened with Russian science over the course of the last ten years and the role of foreign organizations seeking to support Russian science. Their conclusions are cautiously optimistic, but they state that far more needs to be done to ensure that Russian science not only survives but flourishes. Early hopes by some for revolutionary reform have been replaced with the acceptance of evolutionary change. The authors conclude that continuing support for Russian science by Western organizations is imperative and clearly in the interests of both Russia and the West. As they write, "It is essential for the sake of knowledge as a common good; for important international causes such as the environment, biodiversity, and health; for international security in areas of military concern; for good relations between Russia and the West; and, lastly, for the building of civil society in Russia by strengthening the positions of independent-minded intellectuals." And it almost goes without saying that strengthening research and training capacities in the sciences is critical for Russia's ability to compete in a global high-tech economy.

This paper was initially presented at the conference "International Support for Science in Russia and Ukraine: A Ten-Year Retrospective and Look Ahead," held in London on October 22–23, 2001, and jointly sponsored by the U.S. Civilian Research and Development Foundation (CRDF) and the Royal Society. The research and writing of this paper was supported by the CRDF, and the Carnegie Endowment is grateful for its permission to publish the paper in our Working Paper series.

Andrew C. Kuchins
Director
Russian and Eurasian Program
Carnegie Endowment for International Peace

INTRODUCTION

This paper presents a ten-year perspective (since the fall of the Soviet Union) on changes in the organization and financing of Russian fundamental science (both natural and social sciences, with emphasis on natural) and on international support for that science in the same period. We assess the impact of international support in these years and suggest ways of continuing and improving that support.

An appreciation of both the strengths and weaknesses of science at the end of the Soviet period, including its organizational features, is helpful in shaping policies to support and improve science in Russia today. While Russian science has significantly changed in the last ten years, it retains many of the characteristics of the Soviet period. In part one, therefore, we briefly discuss Soviet science as it was at the end of the 1980s and the beginning of the 1990s.

In part two we discuss the crisis that hit Russian science in the period after the collapse of the Soviet Union (1992–1999) and the effects of both the dramatic decline in financial support and the outflow of scientists. We also discuss efforts made in this period to reform the organization of science in Russia.

Part three is devoted to the present situation (1999–2001), and, in particular, the appearance of the first signs of recovery of Russian science. The Russian government has improved its financial support of science, at least to a certain degree, and President Putin has outlined his new science policy. Several new programs promoting the integration of research and teaching and helping young scientists were implemented.

Part four describes and analyzes the activity of international organizations in Russian science, particularly the work of a number of foreign foundations. We describe the ways in which their emphases have changed over time and some of the difficulties they have encountered. We also assess the impact of their activities on Russian science.

In part five we conclude with an overall evaluation of the state of Russian science today and recommend ways international organizations might take into account the latest trends to improve their support of Russian science.

I. SCIENCE AT THE END OF THE SOVIET PERIOD

Science in the late Soviet era was impressive in a number of important ways. At the time of its collapse, the Soviet Union possessed a science establishment that was one of the largest in the world.[1] In addition to this quantitative strength, in fields such as theoretical physics and mathematics, Soviet scientists were qualitatively among the world's leaders.[2] The Soviet Union also proved that it could accomplish important goals in selected practical fields as well, such as nuclear weapons, rocketry, and space exploration. But concurrent with these successes, Soviet science also failed to reach its full potential because of political restrictions imposed by the ruling Communist Party, the bureaucratic features of the organization of Soviet science, and the economic characteristics of a command economy.

Soviet science was organized in three institutional pyramids:

- **Academy system** (the Academy of Sciences of the USSR, including its regional divisions; the academies of sciences of the various republics of the USSR; the Academy of Medical Sciences; and the Academy of Agricultural Sciences). The "academy pyramid" was the home of most fundamental research.
- **University system** (*vuzy* and *vtuzy* in both Russia and the other republics). The "university pyramid" was largely devoted to teaching, with research a much lower priority.
- **Military-industrial complex,** including both the research institutes of the various industrial and defense ministries (*otraslevye instituty*) and also several dozen secret "closed" cities (such as Arzamas 16, a major site of nuclear weapons research). This "military-industrial pyramid" was by far the largest of the branches of Soviet science, but it was severely restricted by secrecy and political controls.

Table A.1 in the appendix gives the approximate numbers of personnel and institutions in these three pyramids at the end of the Soviet period.[3] Although the academy of Sciences system was small compared to that of the military-industrial complex, it was nonetheless a very large organization (called by one Western observer "an empire of knowledge"[4]) and was dominant in fundamental research (in 1990, 64 percent of all basic research was implemented in the academic sector).[5] Several hundred leading institutes conducted research in natural science, the social sciences, and the humanities in the academy system. The state supported all Soviet science in the three pyramids (there were no nongovernmental research organizations), and it distributed the funding in block grants and contracts (there was no peer review system for distribution of grants).

The Soviet scientific system possessed both advantages and disadvantages. Among the advantages were generous governmental and social support for the natural sciences, both financial and psychological; a strong educational establishment, many of whose most academically talented graduates went into the research institutes; and the ability, through political control and the command economy, to concentrate successfully on a few high-priority projects (nuclear weapons, space). Among the disadvantages of the Soviet scientific system were the separation of research and education, and of fundamental research from applied research (a result of the division of functions in the three pyramids already described); the distortion of priorities, particularly toward the military, which recieved about 75 percent of all resources;[6] the low productivity of the research system (especially when one considers the enormous resources devoted to science), a flaw that was connected to the absence of genuine peer review; political restrictions (secrecy; repression of dissidents; prejudice against some ethnic groups, such as Jews; and suppression of certain fields, such as genetics); and, finally, an emphasis on "reverse engineering" of Western innovations. (The reverse engineering approach was not always a disadvantage, however, because Soviet engineers proved adept at first copying and then sometimes improving Western technology.)

During the last years of the Soviet Union, the scientific community was racked by discussions of possible reforms. Newspapers were filled with articles by authors, most of them scientists, criticizing the old Soviet scientific system and calling for dramatic changes. What were the implications for science, they asked, of the transition from an authoritarian party-led state to a new era governed by the principles of democracy and a civil society? For a while it appeared that the old system in which the Academy of Sciences dominated fundamental science was in deep trouble.[7]

The position of the old guard, the supporters of the status quo, was enormously weakened by the events surrounding the abortive putsch in August 1991. When army generals and police officials attempted to reverse Gorbachev's reforms and restore authoritarian, if not totalitarian, rule, the top leadership of the Academy indicated by their silence that they favored retention of the Soviet regime. The leaders of the Academy of Sciences of the Soviet Union believed that their fate was tied to that of the USSR itself. When the coup failed and its leaders were arrested, the leadership of the Academy was, in the minds of their critics, discredited. *This,* the critics thought, was the moment when genuine reform was possible.

Nevertheless, the hopes for a revolutionary change in the organization of Russian science were not fulfilled. A new generation of science administrators emerged in Russia who recognized that to avoid destruction of existing strengths in science and education the changes should be *evolutionary,* not *revolutionary.* Accordingly, the internal efforts at reform were directed toward improving existing institutions, not abolishing them. However, some important changes in the administration and financing of scientific research were made during this period.

After the fall of the Soviet Union and the rapid decline of Russian science, both Russian and Western observers developed a tendency to recall nostalgically the achievements and strengths of Soviet science and to overlook its drawbacks. This tendency was especially marked, understandably, among older Russian scientists who clearly recalled the higher status, salaries, and research support of the previous fifteen or twenty years. Heated discussions continue in Russia about the fate, place, and role of the Academy of Sciences and the best way to organize Russian science. An accurate assessment of both the strengths and weaknesses of Soviet science is necessary to formulate sound policies toward science in the post-Soviet period.

In this section we have discussed events in science up until the collapse of the USSR in December 1991. However, intensive discussion of the organization of Russian science continued after that date; we will return to this subject in part two.

II. THE TRAUMATIC PERIOD (1992–1999)

Effects of Financial Decline and Brain Drain

What were the causes of the deep crisis that Russian science found itself in after the dissolution of the Soviet Union? Following the disintegration of the Soviet Union, a rapid decrease in the status of science and the prestige of research work occurred, both among policy makers and among the general public. Science had been strongly supported by Soviet ideology, and with the discrediting of that ideology, science moved much lower in social and political priorities. With the disappearance of the central all-union Soviet budget, expenditures on science were greatly reduced. In the early post-Soviet period, changing the political, social, and economic systems was thought to be much more important than changing or helping science. Under financial constraints, science was seen as a luxury. And if one takes into account that at the end of the 1980s about 97 percent of the support of science came from the federal budget, it becomes obvious how dramatic the situation was.[8]

Moreover, one of the directions of the early reforms was demilitarization, so defense research and development quickly lost support. The effect of such a rapid change was traumatic because about three-quarters of the total research and development complex was related to defense.

At the same time, attempts by researchers to protest against their new plight were not taken seriously because of what appeared to be greater emergencies elsewhere. The strikes of miners and the dissidence of the military forces were much more dangerous for the power structures than the protest meetings of scientific researchers. As a result, the science and technology sphere was pushed into the background, and the government did not even try to maintain minimum living standards for researchers.

The science crisis of the 1990s can be measured by several indicators, starting with data on financing. The data in table 1 demonstrate how rapid this decrease was.[9]

Table 1. Dynamics of the Expenditures on Science and Changes in the Personnel of the Economic Branch "Science and Scientific Services"

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Share of allocations for civilian science in GNP, %	1.03	0.54	0.49	0.46	0.36	0.34	0.43	0.28	0.32
Share of allocations for civilian science, in % of the total expenditures from federal budget	7.43	2.62	3.11	1.96	1.99	1.80	2.47	1.58	2.15
Personnel involved in research and development, in % to 1990	86.3	78.9	67.7	56.9	54.6	51.0	48.1	44.0	44.9

Sources: Goskomstat RF (State Committee on Statistics, Russian Federation); and Center for Science Research and Statistics (CSRS), *Science of Russia in Figures: 2000* (Moscow: CSRS, 1996), pp. 28, 42, 45–46.

When interpreting this data, one should keep in mind that the gross national product (GNP) of Russia was also rapidly decreasing; federal expenditures on civilian science had dropped approximately fivefold since 1990, while the total expenditures on civilian science from all sources had decreased approximately threefold. The rapid decrease in federal support was exacerbated by two other developments: a decrease in research and development orders from industry, which was also contracting; and an enormous increase in the cost of utilities and community facilities because of the freeing of price controls. As a result, administrators of research institutions had no choice but to practically eliminate the purchase of new equipment in their efforts to maintain salaries. The decrease in the number of organizations was much slower than the reduction in financing and research staff. The average salary of scientific workers soon ranked tenth among eleven branches of the Russian economy; only workers in culture and the arts ranked lower. Because the meager salaries did not meet the minimal needs of researchers, they had to look for additional sources to earn a living, mostly outside the research and development sector. Many scientists observed that “Russian science [was] now the science of survival.” Meanwhile, subscriptions to scientific literature lapsed, equipment continued to age, and attendance at international conferences dwindled.[10]

Although the federal budget remained the primary source of support for science during these years (1992–1999), the share of federal and local budgets gradually decreased by 10 percent and the share of foreign sources of support for science (mostly by contracts rather than grants) increased by the same percentage. The changes in the shares of federal, local, and nonbudgetary sources, as well as changes in the share of self-financing by research and development organizations and foreign support, are shown in Figure A.1 in the appendix.

In addition to the dramatic decrease in financing, another serious blow to Russian science during these years was the "brain drain"—both internal (to other sectors of the Russian economy) and external (abroad). An obvious indicator of this phenomenon was the decrease in the number of scientific personnel in research and development institutions (see table 1). As a result, the average age of researchers in Russia rose. In 1994 the share of researchers who were under twenty-nine years of age was 9.2 percent, and the share of those who were aged thirty to thirty-nine was 24 percent; by 1998 those numbers decreased to 7.7 and 18.1 percent, respectively.[11]

The problem of brain drain is very complicated to capture statistically. There have been no all-Russia comprehensive surveys of this phenomenon, only a number of partial surveys with quite different results. The most conservative estimates give the outflow abroad (both for permanent residence and for long-term contracts) at about 7,000 researchers for the years 1993–1996, and the least conservative estimates give the outflow for the same period at between 30,000 and 40,000 researchers. The Russian Ministry of Science has produced data on external brain drain (for "permanent" emigration, not temporary residence abroad for contract purposes), stating that between 1991 and 1996 there was a rather stable outflow of about 2,000 researchers a year. Since 1997 this average indicator decreased substantially to 1,200–1,400 researchers each year.[12]

Internal brain drain, that is, leaving science for other types of activity, is even more difficult to estimate because it is impossible to collect accurate data. There is a large share of "hidden" internal emigration caused by researchers continuing to list themselves as staff members at a given institute but actually spending most of their time in activities outside science. According to anecdotal evaluations, only about ten percent of all researchers are working full time in the science and technology sphere.

But even the relatively scarce data we possess reveal that the process of external brain drain has changed during the last ten years. By analyzing data from different sources, we conclude that four waves of brain drain may be seen in post-Soviet Russia. Of course, these waves are not absolutely distinct and are only approximations.

The *first wave*, from the end of the 1980s to the early 1990s, consisted largely of elite scientists who were well known in the international scientific community. About 70 percent of the researchers who left Russia in these early years continued their scientific careers at universities and research and development organizations abroad. Another significant outflow at this time was ethnic emigration. Germany and Israel together accepted about 80 percent of all emigrants, but in many cases these newcomers later moved to the United States, seeking more favorable research conditions and immigration laws.[13]

The *second wave* of emigration came in 1992–1993, the time of the most intensive outflow. But only 20–40 percent of the total number who emigrated abroad at this time stayed in science after they arrived in foreign countries.[14] During these years, many scientists in Russia also emigrated internally, permanently leaving science for other activities. It has been estimated that for each scientist who emigrated abroad, another ten left science for another sector of the economy inside the country.[15]

The typical emigrant abroad between 1992 and 1993 was a thirty-one- to forty-five-year-old man with a doctorate, engaged in theoretical research, often having published widely.[16] According to different surveys, in terms of scientific disciplines, physicists and mathematicians composed more than 50 percent of the total number of emigrants, followed by biologists (about 30 percent) and chemists. The biggest share of emigrants was from Moscow, St. Petersburg, and Novosibirsk—the major Russian scientific centers. The distribution of emigrants by countries showed that the first destinations (in descending order) were Germany, Israel, and the United States.

The *third wave* took place from 1994 to 1998. The typical representatives of this wave were biologists (especially in fields such as genetics, molecular biology, and virology), computer science specialists, and programmers. There were fewer physicists, mathematicians, and chemists in this wave, mostly because of diminishing demand for these specialists in foreign countries, especially in the United States. In 1997–1998 external outflow was stable at about 1,000 researchers per year leaving permanently, with an additional 4,000–5,000 researchers per year working abroad on a contract basis. Graduate students and young researchers were prominent among those leaving during these years, resulting in a scarcity of young (thirty to forty years of age) researchers in Russia.[17] During 1996–1998 the number of graduate students from the former Soviet Union (FSU) in American universities increased by 29.5 percent. Russian graduate students abroad outnumbered undergraduates.[18]

In 1999 the *current wave* of emigration started, with the number of emigrants increasing to 1,400 in this year. According to a 2000 survey conducted among researchers from different fields, the major reasons for emigrating at the present time are (in descending order by the number of researchers citing them): (1) low levels of salaries for both research and teaching; (2) ever-worsening shortages of equipment and instruments for conducting fundamental research; (3) absence of prospects for career growth in Russia; (4) low prestige of scientific careers in Russia; and (5) an unstable political situation. Low salaries were cited by more than half the respondents; each of the other reasons by approximately 30 percent.[19]

Characteristic features of this last wave are departure from Russia after first defending a thesis there, and "pendulum migration," a growing number of researchers who move back and forth rather than leave Russia permanently.[20] Western scientists, especially Americans, often strengthen these tendencies by searching for future post-doctoral candidates among graduate students they meet while visiting Russian laboratories. In turn, Russian researchers increasingly seek places in foreign laboratories while they are still in graduate study in Russia. Young researchers have the strongest motivation for emigration, often encouraged and inspired by their older colleagues. As surveys have revealed, 50 percent of researchers of the older generation think that young scientists should go abroad to work temporarily, and 9 percent believe that such young people should leave Russia forever; only 21 percent think that these youths should try to pursue scientific careers in Russia.[21]

Brain drain is still a current problem in Russia. In August 2000, at a meeting with top science officials, President Putin identified brain drain as one of the key problems of Russian science, influencing all science and technology areas.[22] Researchers continue to leave science and only in isolated cases do they return from abroad. Of those who do return, quite a few are involved with practical concerns such as science management or software programming, instead of fundamental research.

Attempts to lessen the severity of brain drain must depend upon improvements in the economic situation of scientists in Russia, not upon regulation of their movements. Although the Russian government has identified this problem, so far it has not found effective ways to address it.

Internal Efforts at Reform

Not unlike brain drain, the question of organization continues to trouble Russian science. In the first months after the fall of the Soviet Union, the old Academy was in a very precarious position. The USSR had broken up into its constituent republics, and already a rival "Russian Academy of Sciences" had arisen, with a different membership from the old Soviet Academy. Many members of the new organization came from areas outside Moscow and St. Petersburg. In its initial conception, this new academy was based on very different principles from the old one. For example, according to its first press releases, the new Russian Academy "does not contain scientific-research subdivisions" and does not provide "material compensation" to its members.[23] If this model had been followed, a dramatic reform of Russian science would have occurred, moving Russia toward either a university-based research system or an institute-based one separate from the Academy of Sciences, such as the Centre National de la Recherche Scientifique (CNRS) in France or the Max Planck Gesellschaft in Germany.

However, as mentioned above, this transition did not occur. The approach of the "revolutionaries" failed, and a new "evolutionary" vision gained the upper hand. An important figure in this evolutionary approach was Boris Saltykov, who served Russia as minister of science from November 1991 to August 1996. Saltykov and the members of his team were very aware of the defects of the old Soviet system of organizing science, and they favored strengthening the universities, relative to the Russian Academy of Sciences, but they also understood that these changes must happen gradually. Leaders of the Academy joined in support of this approach, and all these people opposed throwing out old systems before new ones were developed.

They found a way to make the transition to a new independent Russia without giving up a system of fundamental research based on academy institutes by fusing the two rival academies, the old Academy of Sciences of the USSR and the new Russian Academy of Sciences. The 300 full members and 450 corresponding members of the old Academy were combined in late 1991 and early 1992 with the newly elected 39 full members and 108 corresponding members of the new one to form a single Russian Academy of Sciences (RAN), which took over the research establishment of the old Academy.[24] Thus, this new Academy possessed all the research institutes of the old one, and Russia continued to have a research establishment that was different in its organizational principles from the scientific establishments of most countries in Western Europe and North America and rather similar to that of the old Soviet Union. The new head of the Russian Academy of Sciences, Iurii Osipov, wanted to keep a dominant Academy but also favored moderate reforms, such as the election by junior researchers of representatives in the governing presidium and the creation of a limited system of peer review for research grants.

The idea of some kind of a Russian national foundation for fundamental science, perhaps similar to the National Science Foundation in the United States, arose during the Gorbachev period, but from the very beginning the project was surrounded by controversy.[25] Who would control the foundation—the presidium of the Academy, the Russian government, or the research scientists themselves? Would the foundation distribute grants to scientists acting independently, or would it give funds to institutions whose directors could determine or influence the further distribution of the money? Several organizations of scientists, such as the Union of Scientists, consisting of researchers from academy institutes, universities, and industry, pushed for a foundation independent from both the government and the ruling presidium of the Russian Academy of Sciences. They also called for a system of individual grants, rather than institutional support. The government emphasized that since federal funds would be used to finance the foundation, the government must have the final control, while the leaders of the Academy argued for control by their ruling presidium or its representatives. On all of these questions, compromises were found, some of which are still controversial.

The impact of foreign models was important in the discussions leading up to the formation of the Russian Foundation for Basic Research (RFBR). In 1991 and 1992 several different Russian delegations, with the support of the Carnegie Corporation of New York, visited Washington to talk to officials at the National Science Foundation, the National Institutes of Health, and the National Academy of Sciences.[26] A major problem discussed by the visiting Russian officials was how to combine foreign models with Russian institutions and traditions.

After much discussion and considerable disagreement, two large Russian foundations emerged in the early 1990s: the RFBR and the Russian Foundation for the Humanities (RFH), analogous in some ways to the National Science Foundation and the National Endowment for the Humanities in the United States.[27] Later, another foundation receiving government support was created—the Fund for Assistance to Small Innovative Enterprises (FASIE)—and several nongovernmental foundations appeared as well. However, the RFBR and the RFH are by far the most significant to scholarship and science, even though the budgets of both foundations together amount to only about 7 percent of all government expenditures on civilian research.[28] The fact that the Russian Academy of Sciences receives annual budgets from the state four or five times larger than the combined budgets of the RFBR and the RFH illustrates that peer-reviewed funding is still only a minor portion of support for science in Russia. (For comparative purposes, it is useful to note that the budget of the National Science Foundation in the United States represents approximately 30 percent of federal funds for civilian basic research.) And the strong position of the Academy in the activities of these two Russian foundations is further illustrated by the fact that 60 percent of the grants from the RFBR and 50 percent of the grants from the RFH go to Academy institutes, even though these foundations are responsible for supporting research for scientists throughout Russia, including those in universities.[29] Researchers in the Academy are, of course, often among the best in Russia, but this distribution illustrates that the locus of basic research in Russia continues to be different from that often found in other countries.

Despite the limitations on the size of their budgets and the political constraints under which they operate, the RFBR and the RFH have been very important and beneficial influences in Russian science. First of all, they are new phenomena opposing the "base funding ideology" traditional in Russian science, and they increase the influence and independence of individual researchers. The scientists who apply to these foundations act voluntarily and are able to, at least in some degree, bypass the vertical administrations above the working scientists. By fostering competition and peer review, the foundations increase the effectiveness of Russian science by rewarding, when the system works well, the most talented researchers. This competitive principle also has beneficial effects on the research institutes in Russia, because the grants typically carry “overhead” amounts of 15–20 percent, so that institutes with the largest number of grant holders also benefit financially. And, despite the small size of the grants—in 2001 the average grant from RFBR was 80,000 rubles (about $2,800) with a maximum of 150,000 rubles (about $5,200) for a team of six to ten researchers—they are especially important for purchasing equipment and for travel to foreign scientific conferences.[30] These two vital functions are also areas where foreign foundations in Russia contribute significantly, as will be discussed in part four of this paper.

In 1996 a program entitled “The State Support of the Integration of Higher Education and Fundamental Science for 1997–2000” (Integration Program) was initiated by the Ministry of Education and the Russian Academy of Sciences. It was given the highest status of governmental programs and was officially designated as “presidential and goal-oriented.” Its purpose was to support fundamental research conducted jointly by researchers of the Academy and by those in higher educational institutions. Under this program, Academy researchers teach in universities, and university students conduct research in Academy institutes. The advantage of this program for the Academy is that it gives its researchers a better opportunity to select the best university students and take them into Academy laboratories; the benefit of the program for universities is that it gives their students access to the better equipment usually found in Academy institutes. By itself, however, the Integration Program does not significantly promote the status of universities as loci of high-level research. Nonetheless, this program is important because it recognizes that research is a vital component of education at a time when research in Russian universities is in decline.

The key element in the Integration Program is the creation of Education and Research Centers (ERCs) based on cooperation among universities and Academy institutes. Today 157 such centers are functioning in almost all regions of Russia. Researchers and teachers along with graduate students consider this initiative one of the most successful government programs.

The factor hampering full realization of this program is its poor financing. This program has received only 44 percent of the funds it was promised. This deficit has negatively influenced many aspects of the program, preventing it from achieving a number of its goals. Shortcomings of the program include the inability to improve laboratory equipment and supplies, little funding for participation in international projects, and inadequate opportunities for modernizing telecommunications and increasing access to the Internet.

Science administrators in Russia have found unofficial ways of coping with the difficult financial situation of the last decade. Many institute directors—especially those who head institutes in desirable locations, such as near Moscow and St. Petersburg—have found that renting out institute space is one way to increase revenues. Another way is to encourage researchers to remain on the staffs of the institutes while receiving their salaries from outside activities. Such former researchers are sometimes referred to as “ghost members.” Although these unofficial means of coping with financial constraints significantly relieve pressure on institute directors, they also clearly detract from the active research output of institutes. Important future reforms need to eliminate the reasons for these detrimental means of surviving.

In sum, reform efforts in Russian science have turned away from the radical hopes of the early 1990s toward efforts to achieve gradual, evolutionary reforms. The most difficult step was to overcome stereotypical thinking about science policy and decision making that existed from Soviet times. Meanwhile, Russian science has managed to survive the most difficult years of economic crisis, and over the last two years, the situation in Russian science has gradually improved.

III. THE SITUATION TODAY (1999–2001): FIRST SIGNS OF RECOVERY?

One of the notable events in Russian science in 2000 was the award of a Nobel Prize to physicist Zhores Alferov, a member of the Russian Academy of Sciences. The last time a Nobel Prize in the natural sciences was awarded to a citizen of the FSU was in 1976. Although Alferov's award was made for work done about twenty years earlier, it is an interesting coincidence that the prize was given to a Russian researcher in the same year that signs of recovery in Russian science began to appear. The award of the prize to Alferov was psychologically important to Russian science, signaling that the worst period of crisis was over.

At the end of 1999, two other significant events occurred. For the first time since the dissolution of the USSR, the Russian government actually delivered the sums to science promised in the budget. Starting in 1999, the government began to pay its financial obligations to the Russian Academy of Sciences, and in 2000 it exceeded its planned level of support by 3.3 percent.[31] Second, the number of researchers in Russia began to increase after years of decline. True, the increase in the number of researchers was not large—only by 0.8 percent—but the change in the trend from retraction to growth was an important signal. The increase, however, was only in the government research sector and among private enterprises; in higher education and among nongovernmental organizations (NGOs), the decline continued. Perhaps most noticeable was that the increase in research personnel in private enterprises—1.2 percent—was higher than in any other area. [32]

At the same time that the government began to fully fund its budgetary obligations to scientific research, it also increased its financing of education. In the budget for 2001, the allocations for education grew by 51 percent over the previous year.[33] Also beneficial to education was the large increase in the budget for the development of telecommunications and information technologies. The federal program entitled "Informatization" became one of the most costly federal programs.[34]

The increase in the number of researchers in the business enterprise sector is an important sign of slow recovery because until recently it was exactly this sector that had experienced the highest outflow of personnel and the most serious retraction. This improvement in enterprises may also be attributed to the growing attention the government has given to the defense sector. President Putin, speaking at the May 2000 meeting of the General Assembly of the Russian Academy of Sciences, announced that support of defense-related research and development is one of the major priorities of his policy toward science and technology. A realization of this policy can be seen in the growing expenditures by the government on defense-related research and development. A noticeable redistribution of resources from the civilian sector of the economy to the defense sector is occurring, which is understandable considering that the crisis in Russian science affected the defense sector to a greater degree than the civilian areas.

The government has adopted a rather complex approach to the problem of developing the defense industry, proposing to support not only defense research but also to prepare new personnel for research institutes involved in such work. The government is planning special assistance to higher educational institutions preparing defense scientists. Students studying in specialties related to defense will receive stipends that are four times larger than those for students studying in other fields, and teachers in appropriate defense-related departments will receive salaries that are 30–40 percent higher than those of their "civilian" colleagues.[35]

Besides defense-related science, other priorities announced by the president included the support of fundamental science, the support of young scientists to encourage other young people to enter the field, the development of modern means of telecommunications, and the stimulation of innovation. Putin also gave special attention to the governmental scientific foundations, such as the RFBR and the RFH, saying that their activities must be brought under "control" and that the government should determine their priority areas—suggestions that are worrisome to some researchers in basic science.[36] In 2001 these foundations were requested to change their charters in accordance with existing legislation; they had to be registered as "government organizations." This may mean that individual grants to researchers will decline in importance relative to subsidies for entire organizations, but this situation is still not clear. What roles individual researchers, as opposed to large research organizations, will play in the competition for government foundation grants remains to be seen.

While the central Russian government is increasing its attention to science, the regions of the Russian Federation are doing so as well, and the sources of financing of research and education outside the federal budget are growing. Several industrial groups are increasing their attention to education and, to a certain extent, to young scientists. The first such groups to support undergraduates were the Russian Credit Bank, the philanthropic holding foundation INTERROS (supported by Vladimir Potanin), and the oil company YUKOS. As a rule, stipends are given to the best students in higher education in specialties important to supporters of industry and in those regions where the industrial groups are located. Several programs being planned would give financial assistance to the faculties and departments of higher education institutions with the largest number of students receiving stipends from the industrial groups.

At the end of 2000, Nobel laureate Zhores Alferov created a Foundation for the Support of Education and Science (the Alferov Fund) with an investment of one-third of his Nobel award ($75,000). The goal of the foundation is to support high school students and teachers and undergraduate students as well as to promote high-tech business.[37] The foundation will be based in the Academy's Ioffe Physical-Technical Institute, an organization directed by Alferov.

The support of young scientists and students is a priority of both local administrators and also foreign and Russian philanthropic organizations. It is generally recognized that Russia faces a serious shortage of young scientists, perhaps even a crisis situation. The support of young scientists has become more and more a focus of the government's attention, and in July 2000 the Russian government called for public discussion of a project entitled "Conceptions for the Government Support of Talented Scientific Youth and for the Development of Russian Science Specialists."

Many of the programs to support young scientists are very similar to each other. As a rule, the support will be given in the form of various types of prizes, grants, and stipends awarded on a competitive basis. The Russian Academy of Sciences is a leader in the scale of its support for young scientists, spending about 130 million rubles each year for this purpose.

The RFBR also announced at the end of 2000 a new program for helping young scientists and graduate students (up to thirty-three years of age) who are already working on the basis of earlier grants from the foundation. This additional program was made possible by the Russian government's award of 90 million rubles to the foundation. The RFBR plans to give young scientists 3,000 grants of about 30,000 rubles each (approximately $1,000).[38]

The definition of "young scientist" varies from program to program. As a result, such programs include scientists from 33 to 40 years old, and thus support some scientists who are approaching middle age. This is undoubtedly a positive development, since the shortage of middle-aged scientists in Russia has also become crucial.

In 2000 the president's Integration Program was extended for one more year with the prospect of extension to 2006. This program continues to be very important because at the present moment a paradoxical situation has developed: graduate students are being educated in 538 higher educational institutions but only 384 of these institutions actually support research activity.[39] Only about a fourth of all graduate students have an opportunity to conduct research. Undergraduates are even less involved in research; according to sociologists of education, only about 8 percent of undergraduates participates in research. At the same time, the share of undergraduates who go on to graduate study is about 7 percent. Therefore, it seems clear that the share of undergraduates who do research correlates closely with the number who choose a professional scientific career. A reserve for attracting young people into scientific careers exists here, and that reserve can be tapped by involving more undergraduates in research.

The importance of integrating the work of Academy and university researchers is confirmed by statistics from the RFBR showing that university–Academy cooperative research projects are particularly productive in terms of publication output; in fact, such cooperative projects are more productive than projects conducted entirely within the Academy or entirely within the university system (see appendix, table A.2).[40]

An opinion poll conducted in 2000 among students participating in the Integration Program demonstrated that the involvement of undergraduates and graduate students in the ERCs where they receive both teaching and research opportunities influences positively their decisions to pursue scientific careers. Of the students surveyed who decided to become scientists, 80.5 percent said that their decisions were influenced by their participation in the ERCs.[41] At the same time, this greater interest in scientific careers does not automatically result in the improvement of science in Russia, because 65.3 percent of those who decided to pursue scientific careers also said that they would like to do so abroad if possible. Therefore, the Integration Program and other programs supporting young scientists cannot by themselves prevent brain drain, which is the key factor in significantly improving the working conditions of science in Russia and in changing Russian society's attitude toward science.

As the results of the Integration Program poll show, the improvement of infrastructure and laboratory equipment has become crucial for a variety of reasons: attracting young people to science, conducting high-quality research on topics that are currently at the center of world science, and avoiding safety and environmental problems that can arise when scientists use obsolete equipment. According to recent estimates by specialists on scientific equipment and instruments, of those areas of research currently being emphasized by the government, not one is adequately supplied with modern equipment.[42] The Russian Academy of Sciences, however, is able to update its equipment slightly more successfully than other research organizations because it has received support from Germany for this purpose, and 60 percent of the Russian government's modest allocation for equipment goes to the Academy.[43] The universities are in a particularly desperate situation with regard to modernizing equipment and instruments.

Despite a number of attempts in recent years to reorganize the institutional structure of Russian science—for example, privatization of branch (*otraslevye*) research and development institutions, creation of federal research centers, and others—the three major research pyramids inherited from Soviet times still exist. In fundamental research, the Russian Academy of Sciences still functions as "a big science ministry," with internal distribution of financial resources to its research institutes largely on the basis of block funding. Only a few research universities have appeared in recent years, and the "integration" of research and education at the highest level is proceeding only slowly. On the other hand, at the lower levels of individual university departments, research institutes, and laboratories, support for the concept of integration is strong. Polls show that 66.8 percent of scientists want closer cooperation between Academy and university researchers and maybe even new institutional forms of cooperation. Only 8.5 percent of scientists polled think the situation should stay as it is. About 20 percent express radical views, saying that one institutional form should be absorbed by the other (that universities should be incorporated into Academy institutes or that Academy institutes should be incorporated into the universities).[44] These data indicate that at the present time the scientific community is ready for deeper reforms

IV. POLICY, ACTIVITY, AND IMPACT OF INTERNATIONAL ORGANIZATIONS

The beginning of active participation by foreign foundations in Russia is usually connected with the name of George Soros, whose International Science Foundation (ISF) provided about $130 million over four years (1993–1996) to support basic research in the natural sciences in the FSU. Although Soros was actually not the first person or organization from abroad to come to the aid of scholarship in the FSU, his effort was both early and large. Furthermore, even after the closure of the ISF in 1996, Soros made possible the creation of a new foundation for natural science and engineering in the FSU by donating $5 million to the U.S. National Science Foundation. On the basis of this initiative, the U.S. Civilian Research and Development Foundation for the Independent States of the Former Soviet Union (CRDF) was created, which continues its activities to the present day.

In the 1980s a number of more local and less-well-known programs of assistance were conducted, mostly through academic exchanges. They were implemented on the basis of special agreements with the Academy of Sciences of the USSR by such foreign organizations as the International Research and Exchanges Board (IREX), the Royal Society in London, the German Academic Exchange Service (DAAD), the Swedish Royal Academy of Sciences, the Central European University founded by George Soros, the National Academy of Sciences of the United States, the British Council, and others. Simultaneously there was a growing understanding in the Western research community that Soviet scholarship was on the edge of crisis. Researchers from different countries started to help their Soviet colleagues on a case-by-case basis. Giving such assistance at that time was complicated and even risky because there was almost no legal way to help scientists in the FSU. No appropriate banking system existed in the Soviet Union or Russia by which funds could be transferred, and there were customs barriers to the delivery of scientific literature and equipment. As a result, extra-legal ways were found; cash was simply carried into the FSU by foreign scientists who distributed it at conferences and seminars. In addition, money was sent by registered letters. Only later were regular legal channels for the transfer of aid created.

The American Astronomical Society (AAS) was the first scientific society in the United States to sound the alarm about the catastrophic situation of scientists in the USSR. The AAS set up a committee that appealed to its members for donations. During 1992, $55,000 was collected from members and distributed to individuals in the FSU on a competitive basis. In addition, about thirty institutions in the FSU received scientific periodicals from the AAS.

In 1992 the American Physical Society (APS) implemented a similar initiative. The Alfred P. Sloan Foundation promised to match grants up to $100,000 given by the APS to colleagues in the FSU, and subsequently the same foundation matched the efforts of several other scientific societies. The APS eventually provided a total of $1.3 million in 2,600 grants. It also delivered thousands of scientific journals to the FSU.

The American Mathematical Society (AMS) initiated three different types of aid: individual grants to scientists, delivery of scientific literature, and aid to individual institutes in the form of small equipment and partial support of administrative expenses.

In 1991 and 1992, these three societies—the AAS, the APS, and the AMS—transferred over $1 million and thousands of periodicals to colleagues in the FSU with the help of the Sloan Foundation, the National Science Foundation, and George Soros.

In Europe efforts to help scholarship in the FSU also began, particularly among physicists. European assistance was usually rendered at the governmental level and therefore was slower in getting started than in the United States. In June 1993 the European Commission created the International Association for the Promotion of Cooperation with Scientists from the Commonwealth of Independent States and the Former Soviet Union (INTAS) with a budget of $27 million.[45]

In 1992 several offices of foreign foundations were established in Moscow, including the MacArthur Foundation, the Fulbright Program, and the ISF. In 1992 and 1993, these and other foundations announced their first competitions. The first peak of activity of foreign foundations occurred in 1994 and 1995 when the ISF alone provided 12.6 and 13.6 percent, respectively, of total domestic expenditures on basic research in Russia.[46] In fact, by this time the ISF was only one of a number of sources of foreign support; the actual share of foreign assistance to all Russian scholarship was much higher. In 1995 academician Vladimir Fortov, former director of the RFBR, estimated that "approximately 50 percent of Russian basic science is being financed today from foreign sources such as the Soros Foundation, the International Science and Technology Center (ISTC), INTAS, and others."[47] From 1992 to 1999, as additional foundations started providing support to Russian science, the share of foreign support increased dramatically from zero to 16.9 percent of gross expenditures on research and development (GERD), as illustrated in figure A.1 in the appendix.

Today, in the United States alone, at least forty governmental agencies are involved in science and technology activities in Russia.[48] Sociological surveys show that the most successful Russian research institutions derive 25 percent or more of their budgets from foreign sources. From this point of view, Russia is unique; in comparison with both the developed countries of the West and the former socialist East European countries, the level of foreign participation in research is very high, and the growth of this participation is unprecedented (see appendix, figures A.2 and A.3).

Although each foundation is important for Russian scholarship, the impact of each varies in accordance with its different goals and budgets. Most of the goals of foreign foundations in Russia can be categorized as follows: (1) building a civil society, promoting democratic ideas, fostering Western ideas, and strengthening regional stability; (2) saving Russia's best fundamental sciences and the researchers in these fields; (3) supporting nonproliferation of weapons, converting military complexes to civilian purposes, and preventing loss of defense researchers to "sensitive" countries; and (4) promoting marketization.

The forms and types of support provided by foreign organizations to Russian scholarship have changed over time. At first the most common form of support was individual or group grants for research in Russia, or for scholarships or fellowships to do research outside Russia. Another type of support that grew over time was cooperative grants in which Russian research teams worked together with foreign partners. According to evaluations by specialists, joint research projects with foreign partners encompass more than one-third of all current fundamental research in Russia.[49] The support of cooperative projects is more selective by its nature than individual and group grants. Cooperation may occur only if Russian researchers have already established contacts with foreign partners and demonstrated good research results. Such programs encourage further development of strong teams, but at the same time they lead to a growing gap between strong and weak regions and between strong and weak research laboratories within institutions. Financially, such cooperation is usually not equal. The proportion of "Russian" and "foreign" shares of such grants is about 4:1, and about 80 percent of the grant normally supports the Russian team. Other types of grants are more local but no less important, such as travel grants, library support, telecommunications development, and institutional grants. Often one foundation supports a variety of programs (see appendix, table A.3).

The disciplinary orientation of the foundations active in Russia is approximately the same as in the rest of the world. Most nongovernmental foundations support the social sciences, humanities, and socially important activities such as ecology, gender studies, and the building of a civil society. Only a few foundations support basic research in the natural sciences: ISF, CRDF, Howard Hughes Medical Institute, International Soros Science Education Program (ISSEP), INTAS, INCO-COPERNICUS, DAAD, and such foundations as the MacArthur Foundation and the Carnegie Corporation of New York (which provide funds for Russian natural science through the CRDF).

It is not easy to detect trends in the policies and priorities of foreign organizations toward Russian research; during the last ten years, there was a considerable variety of programs, and this heterogeneity is still increasing. Nonetheless, a certain periodization can be identified:

- 1992–1994: emergency help to Russian scholars—mostly in the form of individual and group grants;
- 1995–1996: growth of cooperation, the appearance of the concept of matching funding, and the active support of the scientific infrastructure (telecommunications, libraries, travel grants);
- 1997: growing support for the idea of institutional funding and institutional reform in Russia science, and for strengthening the bond between basic and applied research, and between research and education;[50] also, the first discussions of special support for young scholars; and
- 1998 to the present: implementation of support for reform.

Foundations tend to give less money but larger grants and to move from support of all areas of research to selected topics (especially true for European programs) and selected categories of researchers (the young, women, university scholars, regional scholars). These trends are not accidental; data on Russian scholarship show a changing demographic profile: a decreasing share of women (from 51 percent in the mid-1990s to 45 percent at the end of the decade), diminishing numbers of young researchers (the share of those younger than thirty years old decreased by 20 percent in the same period),[51] and a constantly decreasing share of research conducted in universities (the share of research carried out in universities decreased in the last five years by 20 percent).[52] Regions are in an increasingly disadvantageous position compared to major urban centers in gaining access to federal funds and foreign resources.

At the same time, there is a visible growth in direct contacts at the level of single organizations (national laboratories, universities, private firms) in which foreign organizations fund joint research. To some extent, this process has been accelerated by contacts between Russian researchers who emigrated and their home institutions. Such contacts have been especially evident in regional centers where the local social and cultural environment leads to more solidarity than in Moscow and St. Petersburg. Regional researchers who emigrate not only maintain connections with their former colleagues but also try to establish partner relations between their new and old institutions, sometimes through creation of new organizations or small firms. Another new tendency is an increased number of programs supporting the material basis of research, not only libraries and telecommunication facilities but also scientific equipment. All parties understand more and more that the supply of modern equipment is becoming a crucial factor in preserving scientific excellence. Deficiencies in modern equipment and infrastructure are among the top factors fostering brain drain away from science and slowing the inflow of young people into it.

The Russian government, in recognizing the importance of the activity of foreign organizations in Russian research and development, has responded in several ways. First, it has created favorable tax and customs regulations for the activity of foundations. The first foundations to be granted tax-exempt status were both Soros institutions—the ISF and the Cultural Initiative. Later INTAS received the same status. Currently, there is a list of foreign foundations and organizations, approved by the Russian government, whose grants have tax-exempt status. Second, the government has begun participating in the work of the foundations, such as the Ministry of Education's financial contribution to the Basic Research and Higher Education Program (BRHE) of CRDF, MacArthur, and the Carnegie Corporation of New York, or the jointly supported RFBR–INTAS competitions. Recently, regional governments have also started to support foreign initiatives, although usually regional administrations cannot provide parity funding (as illustrated by the experience of ISSEP and CRDF). Nonetheless, more and more regions are participating financially in the foundations' programs, which is an important development for the sustainability of certain initiatives. This local support also reveals growing understanding between science policy makers and local authorities. Still, at the present time, the level of regional support to Russian science is low, not exceeding 5 percent of total expenditures on research and development.[53]

Despite the growing appreciation in Russia of foreign foundations, from time to time nationalists and security agencies attack them as "hidden spy organizations." These critics accuse the foundations of attempting to steal secrets and intellectual property. To date, all such attacks have been criticized by the Russian scientific community and rejected by the highest government authorities.

A more worrisome development was the issuance of instructions by the presidium of the Russian Academy of Sciences to its institutions to monitor more closely the foreign contacts of its scientific researchers. This announcement even momentarily caused George Soros to consider ceasing his philanthropy in Russia.[54] Subsequently, however, the presidium of the Academy canceled its earlier announcement and issued a new one that is less alarming.[55] And two academicians in interviews said that the regulations deal primarily with "dual use" research (technology that might be applicable to weapons) and not to normal academic contacts.[56] Soros himself subsequently approved the full budget in Russia of his Open Society Institute for the coming year. Nonetheless, this situation warrants close attention in the coming months. Interference with scholarly communication would be a serious threat, but so far it is not a reality.

After almost ten years of foreign foundation presence in Russian scholarship, it is important to ask what the impact of foreign foundations and their programs has been.

Foreign initiatives have not been large enough to change all of Russian science. Rather, their most important influence has been as "demonstration models" that help adapt science to the new economic and political environment of Russia. Foreign foundations have directly and indirectly influenced the following components of the research system in Russia:

1. New mechanisms of financing research and development have been introduced, particularly open competition for funds and peer-review-based selection procedures. New methods of payment have been instituted, including direct funding of research teams rather than institutions as a whole. These new ways of awarding grants were supported by 75 percent of scholars in Russia in surveys conducted in 1993 and 1994 and by 86 percent in 1995, showing growing acceptance of competition and peer review.[57] By 1999 the new grant system was so widely accepted that it was no longer questioned, and now the discussion continues around the proper balance between grant and block funding.
2. New knowledge has been gained by the Russian scholarly community, such as the art of writing proposals, better awareness of conflicts of interest in grant competitions, and accountability among researchers.
3. Project management has improved, with special emphases on the roles of principal investigators and realistic approaches to the planning of research, budgets, and overhead costs.
4. The material situation of Russian science and scholarship has improved, and brain drain has in some instances been reduced—particularly when grants were awarded for work in Russia and for the promotion of mobility by travel grants and exchange visits. As a result, research excellence was preserved during the most difficult years after the collapse of the Soviet Union (1992–1994). The most evident impact of foundations has been on the standard of living of researchers. For many Russian scientists, foreign grants are more important than their official salaries, since they are usually several times larger. Today's average salary for researchers is 60–90 dollars per month, while grants from foreign foundations usually range from $200–600 per month. In addition, foreign grants are not subject to income tax and value-added tax.

   Surveys of ISF grantees in 1995, when the ISF programs were in operation, and later, in 1998, after they had ceased, revealed that researchers' opinion concerning the influence of the ISF on brain drain changed to a considerable extent.[58] In 1995 almost a quarter of all respondents thought that ISF programs prevented brain drain, but by 1998 nearly all scientists believed that the ISF could *not* contribute to the resolution of the brain drain problem. The foundation's maximum possible impact was assessed as the "temporary deterrence" of the departure of scientists, especially young people. The impact was transitory in the opinion of most respondents because the average grant size was not large and did not permit the purchase of expensive equipment. Furthermore, the duration of the grants in the best cases was two years—not long enough for scientists accustomed to long-range planning.

Sometimes the reverse question is asked: "Do foundations by their activity actually stimulate brain drain?" Surveys conducted among former grantees of the CRDF Cooperative Grants Program have revealed that there is no evident correlation between mobility and outflow. The research fields with some of the highest indicators of mobility (physics and mathematics) had comparatively low levels of outflow (2.4 and 3 percent, respectively, left the country to take positions abroad for more than half a year). At the same time, geology was number one both by level of mobility and level of outflow (3.8 percent of the total number of geologist participants left).

5. Telecommunications facilities (especially those funded by Soros) and access to foreign periodicals, both physically and through the Internet, have improved significantly as the result of support by foreign foundations.
6. The bond between research and teaching has been increased through such programs as the BRHE, and greater attention has been given to regions, the capabilities of women in science, and the needs of young researchers and students. Quite a few foundations have been active in these areas, including CRDF, ISF, INTAS, ISSEP, MacArthur, Carnegie, and others.
7. Greater attention has been given to science as an area of economic activity and to the processes of commercialization of technologies, as well as to intellectual property rights issues and the significance of tax exemptions for research and development activities.

Foreign foundations have helped create a "who's who" in Russian science by highlighting the actively working researchers in research and development institutions and universities. Even today a very popular and often cited statistic is the number of researchers who received emergency grants from the ISF; this statistic is given as an illustration of the number of Russian researchers who deserve support. The ISF gave 20,763 such grants at a time when the number of researchers in the natural sciences was 116,391.[59]

Assessing the immediate and future needs of science and scholarship in the FSU, we see that foreign foundations have to a significant extent met internal needs and have tried to close a number of painful gaps. However, certain areas did not receive enough attention, while others obtained support from many organizations simultaneously. A good illustration was the closure of travel grant programs by a number of foundations at the same time; as a result, today there is a clear shortage of such grants. A survey conducted among Moscow researchers has revealed that only 6 percent of them attend international conferences at least once a year. More than 50 percent of these researchers did not attend any conferences abroad during the last three years.[60] Because we now know from surveys that such grants help reduce brain drain rather than increase it, this shortage needs to be alleviated. Regular research grants are inadequate for this purpose. At the same time, a number of foundations—both foreign and domestic—have initiated various programs to support young researchers and students. As a result, today young people have greater possibilities than their middle-aged colleagues. Additional merit-based competitions (in which products of research are more important than age) would be helpful.

Some other areas that merit the attention of foreign foundations include renovation of instruments and the material basis of research, further development of telecommunications, support of regional science, strengthening of ties between research and education through support of science in universities, encouraging collaboration between teachers and researchers as well as among researchers from different types of institutions. Ideally, there would be mutual awareness by all foundations of what other foundations are doing to avoid duplication of initiatives.

V. CONCLUSIONS

Russian scholarship and science are still in trouble, as they have been for more than a decade, but for the first time since the collapse of the Soviet Union a few positive developments are visible. In the last two years, the Russian government actually delivered the promised sums to science, and the decline of the number of researchers in Russia has, it seems, halted. The feeling is growing among scholars, scientists, and science administrators that the worst period has passed.

Between 1992 and 1999, the enrollments of graduate students in Russia in the fields of physical-mathematical, chemical, and biological sciences grew, respectively, by factors of 1.4, 1.6, and 1.8. To be sure, in some social sciences the growth was even more rapid; for example, in psychology, economics, and law, the growth rates during the same period were 3.1, 3.5, and 4.6, respectively. On one hand, these higher rates seem reasonable considering that the social sciences were more neglected and politically distorted in the Soviet period than were the natural sciences, and therefore Russia's needs in the social sciences were greater. On the other hand, Russia's eminence has traditionally been in fields such as physics and mathematics, and the loss of these strengths through gradual attrition would be damaging not only to Russia but to the world. The continuing expansion of student enrollments in all academic fields in Russia is evidence that growth in new fields can be combined with continued strengths in old ones, particularly if brain drain can be reduced. The most important fact demonstrated by these enrollment statistics is that the thirst of young students in Russia for advanced knowledge in all fields, including natural science, continues unabated.

We have learned during the last ten years that science is not the tender flower it is often thought to be. Science turns out to be capable of robust growth, more like a hardy weed than a fragile blossom. Science in Russia after the fall of the Soviet Union suffered the most precipitous decline in financial support known in modern history, and there were moments when observers predicted "the death of Russian science." We now know that these predictions were false. The support of foreign foundations and governments has been essential in helping Russian science to survive. The philanthropy of the ISF was crucial to the survival of many scientists in the FSU in the desperate years of the early 1990s. Emergency aid of this sort to individuals is now being replaced by support for leading centers of research and education, including overhead for institutions, and by promotion of cooperative research that is not so much philanthropic in nature as it is mutually beneficial.

But just as Russian science has turned out to be robust against destructive forces, so also has it been resistant to efforts to remold Russian scientific institutions along Western lines. The hopes of the more radical reformers, both Russian and foreign, who in the early 1990s wanted to remake totally the institutions of Russian science, perhaps by eliminating or dramatically changing the Russian Academy of Sciences, have turned out to be unrealistic. The institutions of Russian science *do* need to be changed, but it is clear now that the path of change will be evolutionary, not revolutionary, and that Russians themselves will determine the pace and forms of those changes. For the foreseeable future, the organization of Russian science will retain many of its traditional characteristics, including the unusual (by Western standards) strength in fundamental science of the Russian Academy of Sciences.

Cooperation between the Russian Academy of Sciences and the universities is improving. The Russian government's Integration Program and the BRHE (financed by the MacArthur Foundation, the Carnegie Corporation, and the Russian Ministry of Education) are important developments fostering this cooperation. So also is the Carnegie Corporation–MacArthur initiative—analogous to BRHE but in the social sciences—for the establishment in Russian regional universities of Centers for Advanced Study and Education. Recent research indicates that cooperative projects between universities and Academy institutes are the most productive in terms of publication output, more so than universities or Academy institutes working alone. This is important evidence that initiatives fostered by foreign foundations are having positive impacts and should be continued.

Russia is also beginning to create a more effective commercial culture for technology and science, especially in offshore software programming, a field that is currently growing in Russia at 30 to 40 percent annually. Russia still ranks far below other countries, such as India and Ireland, in this area, but it possesses much talent in the field and is already being praised by some foreign companies as a place where difficult programming problems can often be solved. Although software programming is an applied field, rather than fundamental science, it has implications for education and for some research in fundamental science in fields such as mathematics and information science.

It has become increasingly clear that complementarity exists between Russian scientific research groups and Western ones. The programs of INTAS and the Cooperative Grants Program of CRDF are promising initiatives in finding areas of cooperation in science and technology.

The impact of foreign organizations on science and scholarship in Russia has been significant. Foreign foundations have helped create new mechanisms for financing research and development (peer review and competition), new knowledge in research management, better material conditions for researchers, closer bonds between research and teaching, a more productive research system, a spreading awareness of new approaches and methods in the humanities and social science, and the cultivation of the values of civil society. On topics such as environmental research, gender studies, and ethnic relations, the roles of foreign foundations have been crucial.

As foreign foundations continue their support of science in Russia, their administrators may wish to consider efforts to encourage the following trends:

- **Balancing Putin's emphasis on defense research with continued emphasis on civilian research.** Foundations must continue to stress the value of free interchange of scholarship and research among the scientists and scholars of the world and to promote nonproliferation, conversion of military facilities to civilian uses, and marketization.
- **Helping the Russian government cement closer bonds between teaching and research by supporting research in universities and cooperation between universities and Academy institutes.** Research opportunities for both undergraduate and graduate students should be increased.

- **Supporting NGOs involved in research and teaching.** Although there are now quite a few nongovernmental educational institutions in Russia, research and teaching in the natural sciences and technology are still almost completely a government monopoly. It might be wise for foreign foundations to support teaching and research in science and/or technology in several of the strongest nongovernmental universities. A good field to start with would be computers and information technology, an area of study and research that could also benefit the humanities and social sciences in the university in which it is initiated.
- **Continuing to emphasize peer-review and merit-based research funding, approaches that have taken root in Russia but which still greatly need support and expansion.**
- **Emphasizing regional research and teaching, while not excluding major science cities like Moscow, St. Petersburg, and Novosibirsk.**
- **Supporting the purchase of instruments and equipment in research facilities. It is clear that shortages of modern equipment are primary causes of brain drain at the present time.**
- **Supporting international travel (of short duration rather than extended residences of more than a year) when it is beneficial in promoting research.** Support for international travel of short duration limits brain drain, not expands it. Many Russian scientists want to stay in their country, but not if they cannot participate in the international community of scholarship by attending vital conferences and meetings abroad.
- **Improving communication among the various foreign foundations active in Russia so that all know the primary emphases of the others.**

The mood of our conclusion is one of tempered optimism. Although some stabilization in Russian science is now visible, the situation is still a precarious one, with inadequate funding and brain drain (internal and external) continuing to undermine Russian science. Support from Western foundations, governments, and commercial organizations is still essential to the recovery of Russian science and scholarship. At the same time that these organizations help Russian science financially, they can limit brain drain by emphasizing on-site research.

The support of Russian science and scholarship by Western organizations has multiple justifications. It is essential for the sake of knowledge as a common good; for important international causes such as the environment, biodiversity, and health; for international security in areas of military concern; for good relations between Russia and the West; and, lastly, for the building of civil society in Russia by strengthening the positions of independent-minded intellectuals. This support is not charity, but an activity clearly in the common interests of both Russia and the West.

NOTES

1. In 1989 the United States had 4 million scientists and engineers in full-time equivalents (FTE), of which 950,000 FTE were engaged in research and development. In 1990 the USSR had 1.7 million "specialists with higher education engaged in research and development." Comparisons are difficult because data are not entirely comparable. In 1988 the number of researchers per 10,000 people was 53.4 in the USSR and 107.3 in the United States. See Center for Science Research and Statistics (CSRS), *Nauka v SSSR: Analiz i statistika* (Moscow: CSRS, February 1992), p. 171. As early as 1980, two American researchers maintained that the Soviet Union had the largest research establishment in the world; see Louvan E. Nolting and Murray Feshbach, "R&D Employment in the USSR," *Science*, February 1, 1980, pp. 493–503.
2. In the late 1970s, an official report of the National Academy of Sciences in Washington, D.C., rated Soviet physics and mathematics as equal in quality to that anywhere in the world. See National Academy of Sciences, *Review of U.S.-U.S.S.R. Interacademy Exchanges and Relations* (Washington, D.C.: National Academy of Sciences, 1977).
3. Loren R. Graham, *What Have We Learned About Science and Technology from the Russian Experience?* (Stanford, Calif.: Stanford University Press, 1998), p. 157. Statistics revised based on CSRS, *Nauka v SSSR*, pp. 30, 34, 118.
4. Alexander Vucinich, *Empire of Knowledge: The Academy of Sciences of the USSR (1917–1970)* (Berkeley, Calif.: University of California–Berkeley Press, 1984).
5. The distribution in 1990 of basic research in the three sectors as a share of total basic research follows: academic sector, 64 percent; university sector, 13.4 percent; military-industrial complex, 22.6 percent. See CSRS, *Nauka v SSSR*, p. 262.
6. Boris Saltykov, "The Reform of Russian Science," *Nature*, vol. 388 (July 3, 1997), p. 16.
7. For a description of the strident controversies of this time, see Graham, *What Have We Learned*, pp. 74–97; and Loren R. Graham, *Science in Russia and the Soviet Union: A Short History* (Cambridge, U.K.: Cambridge University Press, 1993); also available in Russian: *Ocherki istorii Rossiiskoi i Sovetskoi nauki* (Moscow: Ianus-K, 1998).
8. CSRS, *Nauka v SSSR*, p. 256.
9. Goskomstat RF (State Committee on Statistics, Russian Federation); and *Russian Science and Technology at a Glance: 2000* (Moscow: Data Book/CSRS, 2000), pp. 28, 42, 45–46.
10. According to former Minister of Science M. Kirpichnikov, the equipment base of research is permanently worsening; see *Poisk*, no. 9 (March 3, 2000), p. 2.
11. *Russian Science and Technology at a Glance: 1999* (Moscow: Data Book/CSRS, 1999), p. 37.
12. *Russian Science and Technology at a Glance: 2000*, p. 40.
13. E. Nekipelova, L. Gokhberg, and L. Mindeli, "Emigratsiia uchenykh: problemy i real'nye otsenki," *Migratsiia spetsialistov Rossii: prichiny, posledstviia, otsenki* (Moscow: INPRAN and Rand Corporation, 1994), p. 10; also O. Ikonnikov, *Emigratsiia nauchnykh kadrov iz Rossii: segodnia i zavtra* (Moscow: Kompas, 1993), pp. 90, 98.
14. E. Krasinets, *Mezhdunarodnaia migratsiia naseleniia Rossii v usloviiakh perekhoda k rynku* (Moscow: Population Institute, Russian Academy of Sciences, 1997).
15. I. Ushkalov and I. Malakha, *Utechka umov: masshtaby, prichiny, posledstviia* (Moscow: Editorial URSS, 1999), p. 71.
16. A. Iurevich and I. Tsapenko, *Nuzhny li Rossii uchenye?* (Moscow: Editorial URSS, 2001), p. 76.
17. *Poisk*, no. 47 (November 26, 1999), p. 1.
18. Institute of International Education (IIE), *Open Doors–1997/98: Report on International Education Exchange* (New York: IIE, 1999), p. 15.
19. Center of Sociological Research, "Deiatel'nost' sotrudnikov nauchnykh podrazdelenii vuzov" (Moscow: Ministry of Education of the Russian Federation, December 2000), p. 24.
20. E. Mirskaia, "Rossiiskaia akademicheskaia nauka v zerkale sotsiologii: Empiricheskie issledovaniia 1994–1999 godov," *NG-Nauka* (May 24, 2000). Young researchers cited both the decrease in the number of research and development vacancies abroad and their disappointment with Western research approaches as reasons for the decrease in permanent emigration.
21. This survey was conducted among 500 Moscow researchers in all fields of science and in all types of research organizations. The situation outside Moscow is probably worse; see E. Krasinets and E. Tiuriukanova, "Intellektual'naia migratsiia," *Economist*, no. 3 (1999), p. 75.
22. A. Mirovskaia, "Okhota za rossiiskimi golovami," *Novoe Vremia*, no. 45 (2000), p. 20.
23. Quoted by Aleksei Zakharov, "The Democratic Opposition in the Process of the Creation of the Russian Academy of Sciences," MIT unpublished paper, MIT workshop, April 23–24, 1993, from *Nauka v Sibiri*, no. 2 (1991).
24. "Ot organizatsionnogo komiteta Rossiiskoi Akademii Nauk," *Poisk* (December 6–12, 1991), p. 3.
25. Gennady Kochetkov and Igor Nikolaev, "The Russian Science Foundation: An Unfinished History," MIT Workshop, 1994.
26. Kochetkov and Nikolaev, "The Russian Science Foundation," p. 9. An organizer of these visits on the U.S. side was Harley Balzer.
27. The RFH was created in 1994 and grew out of the "humanities" division of the RFBR.

28. Irina Dezhina, "Effekt prozrachnosti: pochemu ne smolkaet diskussiia o sud'be gosudarstvennykh nauchnykh fondov," *Poisk*, no. 6 (February 9, 2001), p. 5.
29. Dezhina, "Effekt prozrachnosti," p. 5.
30. "Uchenye rabotaiut s koles," interview with M. Alfimov, Chairman of the RFBR Council, *Izvestiia-Nauka* (June 15, 2001), p. 1.
31. "Russian Academy of Sciences in 2000: Rasshirennoe zasedanie Presidiuma RAN," *Poisk*, no. 13 (June 6, 2001), p. 6.
32. *Russian Science and Technology at a Glance: 2000*, p. 31.
33. *Nezavisimaia gazeta* (April 19, 2001).
34. *Poisk*, no. 14 (April 13, 2001), p. 7.
35. *Poisk*, no. 48 (December 1, 2000), p. 2.
36. "Annual Message of the President of the Russian Federation to the Federal Assembly," April 3, 2001.
37. V. Voloshina and Z. Alferov, "Dlia nashego tsentra i milliona malo," *Izvestiia*, no. 45 (March 15, 2001); and "I fond zarabotaet," *Poisk*, nos. 18–19 (May 18, 2001), p. 2.
38. *Poisk*, no. 13 (April 13, 2001), p. 5.
39. Data from *Vyshee obrazovanie v Rossii: 1999* (Moscow: CSRS, 1999), p. 66; and *Ekspress-informatsiia CSRS* (March 9, 2000).
40. See I. Dezhina, V. Minin, and A. Libkind, "Nuzhno li ob'ediniat'sia? Nekotorye otsenki produktivnosti sotrudnichestva akademicheskikh i vuzovskikh nauchnykh kollektivov," in *Voprosy istorii estestvoznaniia i tekhniki*, no. 4 (2001), p. 6.
41. Survey conducted by Irina Dezhina in 2000 in fifteen regions of Russia on a grant from the Spencer Foundation.
42. O. Larichev, V. Minin, A. Petrovskii, and G. Shepelev, "Rossiiskaia fundamental'naia nauka v tret'em tysiacheletii," *Vestnik RAN*, vol. 71, no. 1 (2001), p. 16.
43. Larichev et al., "Rossiiskaia fundamental'naia," p. 17.
44. Center for Sociological Research, "Deiatel'nosti' sotrudnikov nauchnykh podrazdelenii vuzov," Ministry of Education, Russian Federation, December 2000, p. 29.
45. Irina Dezhina, *The International Science Foundation: The Preservation of Basic Science in the Former Soviet Union* (New York: Open Society Institute, 2000), pp. 9–10.
46. Calculated on data from *Russian Science and Technology at a Glance: 2000;* and Dezhina, *International Science Foundation*, p. 151.
47. V. Fortov, "Rossiiskii fond fundamental'nykh issledovanii v 1995," *Vestnik RFFI*, no. 3 (1995), p. 3.
48. *CRDF Newsletter*, no. 1 (April 2001).
49. Larichev et al., "Rossiiskaia fundamental'naia," p. 14.
50. In 1997 the MacArthur Foundation decided to add to its ongoing activities in the former Soviet Union by initiating a new program in support of research in natural science in Russian universities. This program was called Basic Research and Higher Education (BRHE) and was given additional financial assistance by the Carnegie Corporation of New York, the Russian Ministry of General and Professional Education, and local administrations in Russia. It is managed by the CRDF and the Russian Ministry of Education. The distinctive feature of the BRHE Program is that it raises the status of universities as institutions where research is performed and treats research and teaching as inseparable functions. In that sense, it differs from the Integration Program described earlier. Eight scientific research and educational centers have been established in Russian universities under this program, four more were chosen in November 2001, and another four will be chosen in 2002, for a total of sixteen. See Irina Dezhina, "Tsentristskaia model': Pervye itogi bespretsedentnogo rossiisko-amerikanskogo proekta," *Poisk*, nos. 28–29 (July 20, 2001), p. 14.
51. Goskomstat RF, *Science in Russia in 1996* (Moscow: Goskomstat RF, 1996), p. 18; also *Russian Science and Technology at a Glance: 2000*, p. 37.
52. *Ekspress-informatsiia CSRS* (March 9, 2000).
53. "Russian Economics in 1999: Trends and Prospects," *IET*, no. 21 (2000), Moscow, p. 179; "Russian Economics in 2000: Trends and Prospects," *IET*, no. 22 (2001), Moscow, p. 125.
54. "George Soros May Stop Philanthropy in Russia," *Chronicle of Higher Education* (June 15, 2001), p. A41.
55. *Poisk*, no. 26 (June 29, 2001), p. 20.
56. *Izvestiia-Nauka* (June 15, 2001), p. 2.
57. Dezhina, *International Science Foundation*, pp. 153–4.
58. Dezhina, *International Science Foundation*, pp. 158–9.
59. Data are for 1994; see *Russian Science and Technology at a Glance: 1995* (Moscow: Data Book/CSRS, 1996), p. 28.
60. Krasinets and Tiuriukanova, "Intellektual'naia migratsiia," p. 69.

APPENDIX

Table A.1. Organizational Structure of Soviet Science, ca. 1990

Levels of subordination			
Characteristics	**University System**	**Academy of Sciences**	**Industrial and Defense System**
Institutions of the all-country level	State Committee of Higher and Secondary Education of USSR	Academy of Sciences of USSR; Siberian, Urals, and Far East branches of Academy of Sciences of USSR; Academies of Agricultural Sciences and Medical Sciences	Industrial ministries; defense ministry of USSR
Level of union republics	Union–republic ministries; committees of higher and secondary education	Academy of Sciences of union republics	
Level of institutions	Higher educational institutions (*vysshie uchebnye zavedeniia*); universities and colleges, including leading universities (Moscow, Leningrad)	Academic research institutes	Industrial research (*otraslevye institutya*[a]); closed military ("post box") research institutes
Quantitative characteristics of the sectors of science			
Number of institutions	789	1,246	5,938
Number of researchers	311,000	210,000	1,148,000
Share of the total expenditures on research and development	6.8%	12.6%	80.6%

a Examples include institutes of steam turbines, coal mining, electronics, among others.

Sources: Loren R. Graham, What Have We Learned About Science and Technology from the Russian Experience? (Stanford, Calif.: Stanford University Press, 1998), p. 157; and Center for Science Research and Statistics (CSRS) Nauka v SSSR: Analiz i statistika, (Moscow: CSRS, February 1992), pp. 30, 34, 118.

Table A.2. Publication Activity Under Russian Foundation for Basic Research (RFBR) Research Grants (number of articles in peer-reviewed journals per project)

Field of Science	Publication Activity Under RFBR Grants at Large	Publication Activity for Cooperative University–Academy RFBR Grants
Mathematics and mechanics	3.1	7.1
Life sciences and medical sciences	2.9	6.0
Chemistry	3.6	5.6
Physics and astronomy	3.5	5.0
Earth sciences	2.5	3.3

Source: RFBR data base.

Note: Data represent projects completed in 1997.

Figure A.1 Expenditures on Research and Development, by Sources

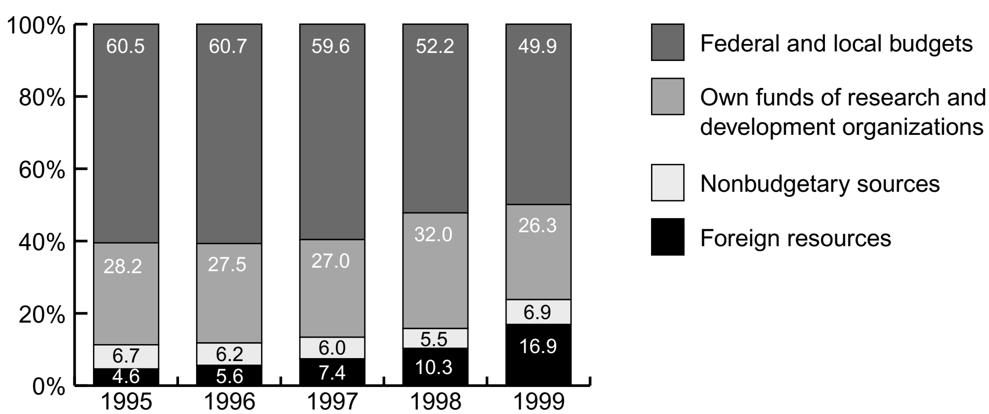

Figure A.2 Percentage of Gross Expenditures on Research and Development Financed Abroad

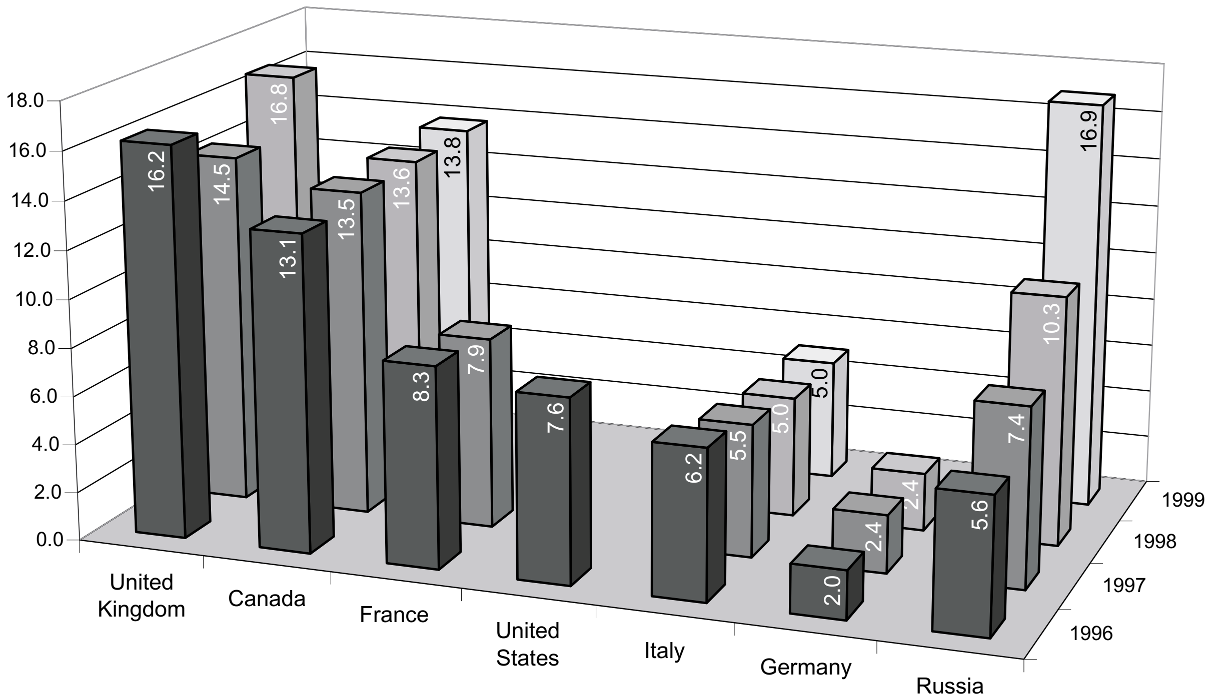

Figure A.3 Percentage of Gross Expenditures on Research and Development Financed Abroad: Eastern European Countries and Russia

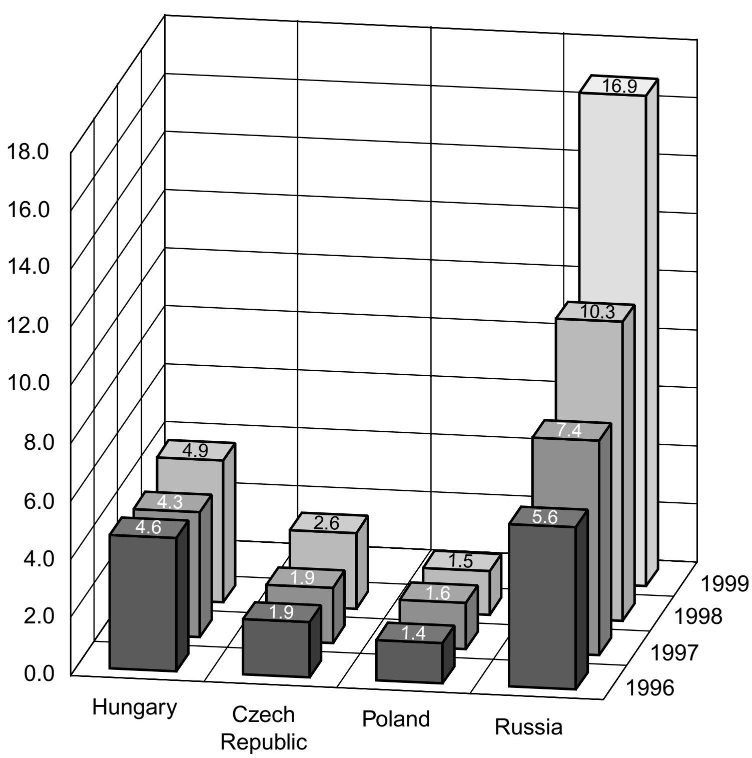

Table A.3. Foreign Organizations with Programs Emphasizing Russian Science

There are many organizations in different countries financing Russian science through grants, contracts, and agreements. Some are governmental, some commercial, some philanthropic, some strictly academic. We list only those organizations known to us, which have created special philanthropic ongoing programs for science in Russia or the former Soviet Union. For a list of many others, see the Internet site <http://courier.com.ru/pril/sprav/0.htm>.

Name of Foundation or Program	**Type of Activity**	**Special Considerations/ Priority Areas**	**Notes**
I. SUPPORT OF RESEARCH PROJECTS IN THE HOME COUNTRY OR ABROAD			
International Research and Exchanges Board (IREX), American Council of Teachers of Russian (ACTR), Kennan Institute for Advanced Russian Studies	Regional science exchange programs in the social sciences and humanities. Grants for fellowships in the United States for 4–6 months.	Researchers from the regions.	Gradual refocusing toward support of political scientists or those with business administration and management specialties.
Fulbright program	Program started in 1992. It provides fellowships for 3–8 months to conduct research or lecturing in the United States in the areas of social sciences and humanities. There are 30-45 awards annually, and during 1992–2000, 483 Russian scholars visited the United States.	In May 2001 a new program for Russian graduate students (up to 30 years old) in arts, humanities, and social sciences was announced. Ten awards will be made for a period of two years each.	
German Academic Exchange Service (DAAD)	Individual grants to FSU university researchers in all areas of natural, social sciences, and humanities to conduct projects in Germany. Duration of fellowships: from three months to one year. Average stipend size: 1,500 DM per month for fellowships of up to one year; 3,500 DM per month for short-term (up to three months) fellowships.	Special focus on German studies and support of young researchers and students (up to 33 years old).	
The British Council	One of its programs promotes linkages between FSU higher education organizations and British universities with the purpose of further joint research projects. Areas of support: economics, small business development, agricultural research, and food production research. Maximum grant size: 20,000 pounds.		Program is administered together with the Know How Fund.

Name of Foundation or Program	Type of Activity	Special Considerations/ Priority Areas	Notes
The John D. and Catherine T. MacArthur Foundation, Program on Global Security and Sustainability, Initiative in the Independent States of the FSU	Moscow office opened in 1992. Foundation awards grants to individuals and special projects. About 100 individual grants awarded annually to conduct research in Russia for up to 18 months. Average annual grant distribution in FSU: $5 million.	Grants awarded in four targeted areas: human rights, environment and society, law, peace and security.	Foundation also supports creation of Education and Research Centers in Russian universities (see below BRHE program under CRDF).
Spencer Foundation	Program started in Russia in fall 1999. Distributes individual grants to young researchers and graduate students to conduct research in Russia in the field of education.	Young researchers and graduate students.	Program is managed through European University in St. Petersburg.
Moscow Public Science Foundation (MPSF) supported by the Ford Foundation	Program started in 1993. Russian Social Sciences: New Perspectives Program makes individual grants to researchers in social sciences and history to conduct research in Russia. During 1993–1999, awarded over 400 grants to researchers.	Young researchers, women, researchers from regions.	
Research Support Scheme (RSS) of the Open Society Institute (OSI)	Awards grants for up to two years to conduct research in Russia in the areas of social sciences and humanities. Since 1991, disbursed more than $18 million.		In November 1999 OSI board decided to discontinue RSS, with the last call for competition in 2000. Funds will be redirected toward institutional development—in particular to support Russian regional universities in the area of social sciences and humanities.
International Association for the Promotion of Cooperation with Scientists from the Commonwealth of Independent States and the Former Soviet Union (INTAS)	Association started in June 1993. It supports joint research projects with at least two European partners to conduct research in the home country for up to three years. Program supported 23,000 individual scientists from the newly independent states who have been involved in 2,652 INTAS projects, with 90% of awards in natural sciences and engineering and 10% in social sciences and humanities. Grant size varies from 60,000 to 150,000 Euro depending on the area. For 2000 and 2001 calls, total budget was 30 million Euro.	Since 1999 special consideration is given to projects with young researchers.	In 2000 a New Young Scientists Program was announced with the budget 1 million Euro. Four types of fellowships are suggested, and grants range between 3,500 and 6,000 Euro per year.

Name of Foundation or Program	Type of Activity	Special Considerations/ Priority Areas	Notes
The Netherlands Organization for Scientific Research (NWO)	The Dutch Russian Cooperation program started in 1992 and is administered by the NWO in cooperation with the Russian Foundation for Basic Research. Since its inception, a total amount of $20 million was distributed for implementation of 250 projects. A total of 2,500 were supported.		On average, 10%–15% of the total resources were allocated to young scientists (younger than 35 years old).
Wellcome Trust	Program started in 1993. It provides collaborative research grants in Russia and the Ukraine in both basic and applied fields. Since 1993, it has supported 83 researchers who participated in 36 projects, with grants totaling about $3.9 million.		
U.S. National Science Foundation (NSF)	Cooperative Research Program with the Newly Independent States started in 1992. Since then, it has awarded 800 research grants and supported 2,000 Russian scientists engaged in basic research, with total program expenditures of $15 million.		
Civilian Research and Development Foundation for the Independent States of the Former Soviet Union (CRDF), Cooperative Grants Program	Supports joint FSU-U.S. research projects for up to two years. In 1995–1997, program made 281 awards, with average grant size varying from $30,000 to $70,000 depending on the field of science.	Special attention is given to young researchers and women as well as to projects from regions and universities.	
Howard Hughes Medical Institute	Makes five-year grants to Russian researchers in biomedical area, with grant size varying from $40,000 to $90,000 annually. Awarded a total of 34 grants in Russia, 30 of them to grantees in Moscow institutions.		
Fogarty International Center of the National Institutes of Health (NIH)	Fogarty International Research Collaborative Awards for FSU health scientists started in 1992. They provide two-year awards ($30,000 per year) to U.S. investigators. All awards are to be spent in the FSU on salaries, supplies, and similar items, with the number of awards each year totaling 35.	FSU researchers in the area of health.	Program provides about $900,500 annually to FSU researchers.

Name of Foundation or Program	Type of Activity	Special Considerations/ Priority Areas	Notes
The International Science and Technology Center (ISTC)	Organization started in 1994. It promotes the nonproliferation of weapons technology of mass destruction by funding research projects (including joint ones) in the areas of physics, environment, biomedical research, energy, and others for up to three years. Average grant size: $400,000. As of end of April 2001, the ISTC gave 1,250 awards totaling $335 million.	Former weapons scientists.	
II. TRAVEL GRANTS			
INTAS	Started in 1999 to make travel grants to young (up to 35 years old) researchers to participate in conferences. It also includes fellowships of up to three months for young researchers to conduct their projects abroad.	Young researchers.	
Cooperation in Basic Science and Engineering (COBASE)	NSF-supported program administered by NAS. Supports 2- to 8-week visits of FSU scholars to their U.S. colleagues to develop joint proposals for NSF.	Young researchers and researchers from regions.	Before 2000 COBASE also provided fellowships of up to 6 months for Russian researchers to conduct joint research in the United States with their U.S. colleagues.
CRDF	Program started on June 1, 1999. Provides travel grants for FSU researchers working in commercially oriented research and development areas		
III. PROMOTION OF INTERDEPENDENCE BETWEEN RESEARCH AND EDUCATION IN UNIVERSITIES/ INSTITUTIONAL SUPPORT			
International Soros Science Education program (ISSEP)	Program started in 1994. Among different initiatives, it provides individual support to professors and assistant professors in the fields of the natural sciences who combine lecturing with research in Russian higher educational institutions. During 1995–2000 awards were made to 1,972 Soros professors and 1,851 Soros assistant professors. During 1994–2000, total amount spent for all ISSEP programs was $109.5 million (in Russia, $101.75 million), with the number of ISSEP grantees (researchers, students, graduate students, teachers) totaling 30,000.	There are no specific priorities, and selection is made on the basis of two major criteria: science citation index and quality of lecturing as evaluated by students.	Starting in 2000, George Soros covers only administrative costs and grants to professors emeritus (about 200 grants of $200 per month per grantee). Grants to professors and assistant professors are paid in those regions where local authorities are willing to provide support.

Name of Foundation or Program	Type of Activity	Special Considerations/ Priority Areas	Notes
International Center for Advanced Studies (INCAS) in Nyzhny Novgorod supported by OSI	Initiative started in 1995. It provides grants of up to 6 months for joint research and educational projects with foreign partners. Research programs include an educational component: each foreign participant gives a lecture course or conducts special seminars for students in the region. Support for the center comes from three sources: OSI (50% of total financing), local sources, and the Ministry of Science and Technologies of the Russian Federation.	Each project should involve young researchers and students.	Support in the field of natural sciences, economics, and, since 1999, humanities. In 2000 OSI decreased its support for INCAS, and prospects for future funding are not clear.
CRDF, the Program for Basic Research and Higher Education in Russia (BRHE)	Makes institutional awards for establishing Education and Research Centers (ERCs) in selected departments of Russian higher educational institutions in the fields of natural sciences. An important component of the program is support of young researchers and students. Awards are about $1 million for a three-year period and may be spent for purchase of equipment, supplies, individual financial support, travel, and conference participation. Currently eight awards have been made, and four new ERCs were to be selected in November 2001.	Young researchers and students: not less than 10% of each ERC's budget must be spent supporting youth.	Half of the total financing is provided by the MacArthur Foundation and Carnegie Corporation of New York through the CRDF, 25% by the Ministry of Education of the Russian Federation, and 25% by local Russian sources.
OSI, Program to Support Basic Departments (kafedry) in Russian Higher Educational Regional Institutions	Program started in 1999 with seven pilot projects, $120,000 each. Makes institutional awards in the fields of social sciences and humanities to kafedry. In 2000-2001, it made 20–25 awards per year. Grants may be spent for individual financial support, travel, and conference participation. Complementary support is also provided for collaborative projects with other institutions.	Special emphasis is on young researchers (up to 35 years old) and students, who must comprise at least 50% of project participants.	
Moscow Public Science Foundation (MPSF)	Program initiated in April 2000 by the Carnegie Corporation of New York, which proposes to extend its financial support of the program for the next six to eight years. Its goal is to establish Centers for Advanced Study and Education (CASE) in the social sciences and humanities in Russian regional universities. To date, three CASEs have been created, and five more will be established in the near future. Each CASE received a $224,000 award for a period of 1.5 years.	Young researchers.	Program is implemented by the Moscow Public Science Foundation, the Ministry of Education of the Russian Federation, the Kennan Institute for Advanced Russian Studies (United States), with financial support from the Carnegie Corporation of New York and the John D. and Catherine T. MacArthur Foundation.

Name of Foundation or Program	Type of Activity	Special Considerations/ Priority Areas	Notes
IV. ASSISTANCE AND TRAINING IN TECHNOLOGY COMMERCIALIZATION AREA			
INCO-COPERNICUS	Program of European Union, started in 1994. It supports joint applied projects in selected areas with three to six European partners from at least three countries for up to three years. One of the partners should be a small- or medium- business representative. Project should have clear prospects for further commercialization of results. Average grant size is 25,000–28,000 Euro. In all, program authorized more than 300 contracts for about 20 million Euro for nearly 250 institutions in the newly independent states. Budget for 1999–2002 is 28 million Euro.	The projects started in 1999. Proposals must fall into one of three priority areas: health care matters, environmental problems, and production technologies.	Representatives from the newly independent states may participate on a shared-costs basis. In addition, since 1999 training and conference support is available for program participants.
CRDF, Next Steps to the Market Program	CRDF co-shares with American for-profit companies joint projects with FSU partners that may lead to technology commercialization. Program aims to facilitate commercial utilization of research results in the interest of all parties involved. The CRDF's investment in each project typically averages $75,000 for a period of up to two years. The level of CRDF cost share depends on the company size.		Grants may be used for individual financial support, equipment and supplies, and travel as well as for various business development activities, including training in technology commercialization, management, and intellectual property issues.
Technical Assistance for the Commonwealth of Independent States (TACIS), Innovation Centers and Science Cities of Russia Program	Project started in 1999 and will continue for two years. Program supports innovation-technology centers in four Russian regions, mostly by providing consulting and training services.		
United Nations Industrial Development Organization, Commercialization of R&D Program	Project started in 1999 and will continue for two years. Program provides consulting and training services for researchers and administrators.		
Fraunhofer Management Gesellschaft mbH	Moscow office opened in 2000 to promote technology commercialization of FSU research and development results in the West and to assist in searching for Western partners.		

ABOUT THE CARNEGIE ENDOWMENT

THE CARNEGIE ENDOWMENT FOR INTERNATIONAL PEACE is a private, nonprofit organization dedicated to advancing cooperation between nations and promoting active international engagement by the United States. Founded in 1910, its work is nonpartisan and dedicated to achieving practical results. Through research, publishing, convening and, on occasion, creating new institutions and international networks, Endowment associates shape fresh policy approaches. Their interests span geographic regions and the relations between governments, business, international organizations, and civil society, focusing on the economic, political, and technological forces driving global change. Through its Carnegie Moscow Center, the Endowment helps to develop a tradition of public policy analysis in the states of the former Soviet Union and to improve relations between Russia and the United States. The Endowment publishes *Foreign Policy,* one of the world's leading magazines of international politics and economics, which reaches readers in more than 120 countries and several languages.

ABOUT THE RUSSIAN AND EURASIAN PROGRAM

With a set of distinguished experts in Washington and a talented group of Russian policy analysts at the Carnegie Moscow Center, THE RUSSIAN AND EURASIAN PROGRAM brings unique resources to the study of policy issues relating to Russia and the other post-Soviet states. Through research, publishing, seminars, conferences, exchanges, and other public outreach activities, the Program promotes informed public debate and provides insights and knowledge to policy makers in both the United States and Russia on key economic, political, and security topics.

Carnegie Working Papers

2002

24 *Russian Basic Science after Ten Years of Transition and Foreign Support,* Irina Dezhina and Loren Graham

2001

23 *Revisiting the Twelve Myths of Central Asia,* Martha Brill Olcott

22 *A Greener Fast Track: Putting Environmental Protection on the Trade Agenda,* John J. Audley

21 *The Internet and State Control in Authoritarian Regimes: China, Cuba, and the Counterrevolution,* Shanthi Kalathil and Taylor C. Boas

20 *Are Russians Undemocratic?* Timothy J. Colton and Michael McFaul

19 *Pitfalls on the Road to Fiscal Decentralization,* Vito Tanzi

18 *The Myth of Output Collapse after Communism,* Anders Åslund

17 *Breaking the Labor-Trade Deadlock*, A Joint Publication of Carnegie Endowment's Economic Reform Project and the Inter-American Dialogue

2000

16 *The Clinton Record on Democracy Promotion*, Thomas Carothers

15 *Intervention in Internal Conflicts: Legal and Political Conundrums*, Chantal de Jonge Oudraat

14 *Privatization and the Distribution of Assets and Income in Brazil*, Roberto Macedo

13 *Democratization and Globalization: The Case of Russia*, Yuri Fedorov

12 *Party Formation and Non-Formation in Russia*, Michael McFaul

11 *Drug Trafficking on the Great Silk Road: The Security Environment in Central Asia*, Martha Brill Olcott and Natalia Udalova

10 *Naturalization in the Wake of Anti-Immigrant Legislation: Dominicans in New York City*, Audrey Singer and Greta Gilbertson

09 *Natural Resources, Human Capital, and Growth*, Nancy Birdsall, Thomas Pinckney, and Richard Sabot

08 *Democracy Assistance and NGO Strategies in Post-Communist Societies*, Sarah E. Mendelson and John K. Glenn

1999

07 *The Challenge of Semi-Authoritarianism*, Marina Ottaway and Martha Brill Olcott

06 *The Rise and Fall of START II: The Russian View*, Alexander A. Pikayev

05 *Putting Education to Work in Egypt*, Nancy Birdsall and Lesley O'Connell

04 *The Campaign for the Unpaid Wages Prohibition Act: Latino Immigrants Change New York Wage Law*, Jennifer Gordon

03 *Intergenerational Mobility in Latin America: Deeper Markets and Better Schools Make a Difference*, Jere R. Behrman, Nancy Birdsall, and Miguel Székely

02 *Politics at the Heart: The Architecture of Humanitarian Assistance to Afghanistan*, Paula R. Newberg

01 *No More Secrets? Policy Implications of Commercial Remote Sensing Satellites*, Ann M. Florini and Yahya A. Dehqanzada