U.S.-Iran Engagement in Science, Engineering, and Health (2000-2009): Opportunities, Constraints, and Impacts

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Opportunities, Constraints, and Impacts

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Office for Central Europe and Eurasia
Development, Security, and Cooperation

Policy and Global Affairs

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

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Acknowledgments

The large numbers of American and Iranian scientists who have participated in the program described in this report deserve many accolades for their contributions to science and to international understanding. Such contributions often have lasting impacts. Should there be opportunities for the opening of more channels for scientific cooperation, these scientists will be good sources of informed suggestions concerning on-the-ground program activities and associated enthusiasm for moving forward.

The Iranian Academy of Sciences and the Iranian Academy of Medical Sciences were the initial partners in Iran for this program. The support of their leaders and staffs over many years is deeply appreciated. They in turn have encouraged other Iranian institutions to become active participants. The contributions of these institutions are also gratefully acknowledged.

The Department of State has played an important role in facilitating the program of the National Academies. The leadership and responsible staff officers of the department have encouraged a wide variety of exchange activities. They have generously shared their insights with the National Academies on developments in Iran. Also, they have been attentive listeners to the observations and suggestions from participants in the program of the National Academies.

Several organizations in the United States and abroad, which have provided substantial financial and in-kind support for the engagement program, deserve special recognition. They include the former W. Alton Jones Foundation, which helped launch the program; the Richard Lounsbery

Foundation, which contributed critical support as the program matured but continued to encounter turbulent times; the Carnegie Corporation of New York, which has provided substantial resources to sustain the program; and the Ploughshares Fund and the International Council on Life Sciences, which supported important projects. The Fondation des Treilles, the Rockefeller Foundation's Bellagio Program, and the University of Helsinki have provided excellent venues for six workshops and meetings. The University of California at Berkeley, the University of California at Irvine, and the University of California at Davis have played central roles in organizing workshops and related events in California. Finally, throughout the decade of engagement, the leadership of the National Research Council has provided strong support and consistent funding to ensure that the program would continue despite political and administrative barriers to implementation.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Academies' Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the process.

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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. Responsibility for the final content of this report rests entirely with the author and the institution.

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Summary

During the first decade of the 21st century, the National Academies, working with a number of partner organizations in Iran, carried out a program of U.S.-Iran engagement in science, engineering, and health (herein referred to as science engagement). This summary, supported by the complete report, reviews important aspects of the science engagement program, including: (a) objectives of the program, (b) opportunities and constraints in developing the program, and (c) scientific and political impacts of the activities. Suggestions for future activities that draw on the conclusions and recommendations that have emerged from workshops and other types of interactions are set forth. Of course, the political turmoil within Iran and uncertainties as to the direction of U.S.-Iran government-to-government relations will undoubtedly complicate initiation and implementation of new science engagement activities in the near term.

The Statement of Task for this report is as follows:

> *The report will document the history of the National Academies' cooperation with Iran over the past 10 years. It will describe the nature of the workshops, pilot projects, individual visits in both directions, continuing consultations, and types of relationships that have been developed and have flourished between U.S. and Iranian scientists, engineers, and health professionals during this period. It will comment on the significance and impact of the activities, practical considerations in carrying out activities, and opportunities for future work.*

PROGRAM OVERVIEW

The primary objective of the National Academies in embarking on an engagement program has been to achieve scientific benefits for both sides and for the international community more broadly. At the same time, many American and Iranian participants and important government officials in the United States and Iran have believed that science engagement can contribute to the evolution of an improved political environment for development of less adversarial relations between the two governments.

Iran has significant science capabilities in a number of fields of regional and global interest. However, in many ways the Iranian scientific community has been isolated from the main stream of international science. The engagement activities have been designed to enable scientists from the two countries to benefit more fully than had previously been possible from cooperation in science education, research investigations, and applications of technology in areas that the two governments consider non-sensitive.

At the same time, it has not been possible to insulate U.S.-Iranian exchanges from the strained relationship that has existed between the two governments for many years. However, with two important exceptions that are discussed below, cooperation in science has been possible without excessive political or security interference in either country.

More than 500 scientists from over 80 institutions in the two countries have actively participated in engagement activities sponsored by the National Academies together with partner organizations in Iran. Hundreds of additional scientists in the two countries have met with professional colleagues from abroad during site visits. Thousands of Iranian scientists and students have witnessed, in person and via live Internet broadcasts, lectures that were delivered by American scientists in Iran.

Seventeen jointly organized workshops, usually involving about 25 participants, have been the primary mechanisms for carrying out this engagement effort. An important criterion in selecting topics for workshops has been ensuring a symmetry of interests and capabilities. Each side has been expected to bring ideas to the table so that neither side dominates discussions. The workshops can be clustered as follows.

- Food-borne Diseases (2),
- Effective Use of Water Resources (3),
- Earthquake Science and Engineering (2),
- Science, Ethics, and Appropriate Uses of Technology (2),

- Science and Society (2),
- Preventing and Responding to Crises (2),
- Ecology and Energy (2), and
- Higher Education and Research Challenges (2).

Additional activities have included the following:

- individual exchanges in both directions involving 25 travelers,
- six joint planning meetings,
- visits to Iran by four American Nobel Laureates, and
- a three-year pilot project in Iran on food-borne disease surveillance.

In 2000, the leaderships of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine met with counterparts from the Iranian Academy of Sciences and Academy of Medical Sciences to begin to chart the initial engagement course. Leaders of these institutions met several additional times during the early 2000s to help ensure that the engagement effort was responsive to scientific interests of the two countries, was flexible to accommodate unanticipated administrative problems, and was appropriate in a volatile political environment. Throughout the decade, these leaders played important roles in ensuring continuation of the program as the navigation of projects through increasingly hostile political environments became more and more difficult.

The engagement activities were complicated to arrange. The workshops, for example, usually have taken 12 to 18 months to organize, despite efforts of the sponsoring organizations to show near-term results. More than a dozen activities were either cancelled or postponed due to administrative issues that arose during the planning process. Representatives of the two governments as well as the partner organizations in the two countries repeatedly expressed support for the program. However, obtaining visas on time, processing license applications in accordance with U.S. regulations concerning economic sanctions, and arranging for the presence at events of both key scientific leaders and younger rising researchers were always difficult. Also, obtaining financial support for engagement activities that often seemed uncertain has been challenging.

SCIENTIFIC INTERESTS

Tangible and intangible scientific benefits frequently result from the sharing of experiences among scientists who are working in similar fields but in different geographic and cultural environments. Such benefits are usually apparent to the participating scientists. Consultations during workshops, one-on-one interactions, and site visits often sensitize the participants to the strengths and weaknesses of approaches used by foreign counterparts in addressing problems of mutual interest. Such insights then help scientists to better evaluate the integrity and importance of findings that their colleagues report in published and unpublished technical manuscripts, including documents that were not even known to exist before cross-boundary discussions began. Sometimes they identify findings from investigations in one physical environment that help explain the scientific aspects of similar problems encountered in other settings. Also, joint efforts at times clarify the magnitude and importance of technical issues that should be of international concern but are not receiving adequate attention in national programs. All of these benefits have been evident, at times, in U.S.-Iranian interactions.

The importance of scientific publications that meet international standards has been a frequent discussion topic during the engagement program. Iranian counterparts are proud of their achievements in raising the profile of Iranian science through a growing number of publications in international journals formally recognized by the Institute for Scientific Information (ISI). They have emphasized that the number of publications co-authored by Iranians and colleagues from abroad has been on the rise and that Americans are the most frequent foreign co-authors. Joint efforts of an American and Iranian participant in the program led to the recognition by ISI of an additional Iranian journal, entitled *Scientia Iranica*, which covers a wide spectrum of science and technology findings by Iranian and other researchers. In short, the engagement effort has increased the awareness of Iranian participants of the importance of internationally acceptable scientific publications as one measure of the progress of Iranian science.

The National Academies have given high priority to the preparation of Proceedings of the workshops, either by National Academies Press or by collaborating institutions in the United States, Iran, and Finland. Participants in workshops have known in advance that they were expected to contribute to the Proceedings, which have underscored that the workshops are meetings for serious scientists. The published Proceedings have been particularly popular in Iran where they have reached scientists who were not able to participate in the workshops.

In short, the exchange activities, and particularly the workshops and associated visits, have helped clarify for visitors from abroad areas of scientific strengths in the two countries while highlighting relevant publications. They have identified scientific problems that seemed appropriate for further joint efforts. In a few instances, they have stimulated follow-on actions by Iranian counterparts to strengthen the approaches within Iran in addressing problems of importance to broad segments of society.

ADDRESSING ISSUES OF GLOBAL INTEREST

The most ambitious collaborative undertaking to date has been a pilot project to set the stage for larger efforts to upgrade surveillance and response systems for outbreaks of food-borne diseases, which frequently occur in Iran. Such diseases are commonly encountered in the United States and other countries as well, and the upgraded approaches now used in Iran have been taken by Iranian project participants to at least one country in Africa. Also, monitoring for food-borne problems can be important in demonstrating surveillance techniques that should be considered in coping with other types of diseases.

About 340,000 inhabitants live in the area that was covered by the pilot project northeast of Tehran. The project involved establishment of a reference laboratory, training of dozens of health-care workers, and development and implementation of upgraded protocols for collecting and analyzing stool samples while following up to identify the sources of the outbreaks. Relevant departments of the Iranian Government and a number of Iranian medical universities were very interested in the results. Representatives of the World Health Organization commended the effort.

Other activities sponsored by the National Academies that attracted considerable interest both in the United States and Iran were the workshops and associated planning activities devoted to seismic science and engineering, effective use of limited water resources, and environmental issues with both short-term and long-term impacts. Parallel interests were identified in addressing these problems in Iran and in the United States. Suggestions for areas for future cooperation were identified. The Proceedings were of particularly high quality, and Iranian officials and scientists in both countries were pleased to receive them. Of special concern during workshops and related consultations were indications that (a) a major earthquake may in time destroy bridges and buildings in Tehran that were not designed to withstand high intensity seismic shocks, (b) biodiversity will continue to

decline in the Caspian Sea basin and in other regions of Iran, and (c) dust storms that impacted Tehran in 2009 due to sand uptake far to the west of the city may become common.

Several other themes of global interest arose frequently in discussions at workshops and during exchange visits by individual scientists. They included, for example, concerns over the inadequacy of university programs that address the ethical aspects of engineering and medical science. In another area, Iran has long had a centralized distance education program that reaches over 400,000 university students; but this program and related efforts lag behind in the use of electronic technologies to facilitate such efforts. Several Iranian presentations about the Islamic concepts of science and wisdom provided important perspectives in addition to the American and Iranian presentations of evidence-based scientific findings. The intersection of science and religion was an over-arching topic on several occasions. Finally, positive views on the importance of cooperation in science often dominated the final sessions of workshops.

IRANIAN ADMIRATION OF U.S. SCIENTIFIC ACHIEVEMENTS

From the outset of the engagement effort, Iranian participants usually entered into the program with positive images of U.S. achievements in science and of the scientific strengths of U.S. universities. Some had graduated from U.S. universities decades earlier; others had relatives and friends in the United States; and still others were frequent viewers of western television programs and/or regular readers of western publications that reported U.S. technological achievements. Those who traveled to the United States usually indicated to the National Academies that their positive views were reinforced during the visits. Those who served as hosts for Americans in Iran seemed to be proud to be in the company of U.S. scientists from well-known institutions. Indeed, the capabilities of the universities and research centers that were the home bases of American participants were usually well known to Iranian hosts.

The enthusiasm with which Iranian scientific colleagues received U.S. Nobel Laureates traveling to Iran was truly astounding. The fact that the Laureates would take time to visit Iran was deeply appreciated by their hosts and by dozens of students with whom they had private discussions as well as by hundreds of additional scientists and students who attended their lectures. One Laureate received an honorary degree. Another Laureate was measured for a sculptured bust, which now adorns the garden of the Techno-park in

Pardis, Iran. Two were received by a leading Grand Ayatollah of the country, and all were greeted by senior Iranian officials as honored guests.

The Iranian press was quick to report the arrival of Nobel Laureates and other leading American scientists in Iran. Government officials offered generous praise in their public greetings of the visitors as well as in private meetings. Academic colleagues were eager to engage in discussions of scientific achievements. Students repeatedly asked how it felt to be a famous scientist. The flags, posters, and programs prepared for the visits by the Nobel Laureates quickly became collector items in Iran.

POLITICAL ISSUES

During the first decade of engagement of the National Academies, the Department of State consistently encouraged the development of people-to-people programs by U.S. non-governmental organizations in many fields, including science. Department representatives frequently stated that the long-term payoff from such engagement can contribute significantly to general U.S. foreign policy objectives of positive international relationships and mutual understanding. Representatives of the National Academies often meet with senior U.S. officials to help ensure that the engagement activities complement other exchange programs. The view of the government officials is always the same. "We are eager to learn about your experiences with Iranians."

In parallel, for many years U.S. officials have strongly advocated publicly that Iran adopt and adhere to democratic principles in the evolution of its governing structure. In recent years, the U.S. Government has financed efforts by non-governmental organizations based in the United States and elsewhere to assist in this respect. Some Iranian officials are suspicious of such activities, and this financial investment by the U.S. Government casts an ominous shadow over all types of engagement, including science engagement.

In a highly publicized action in 2006, Secretary of State Condoleezza Rice successfully sought a special Congressional appropriation of $75 million to finance expanded radio and television broadcasts into Iran and to initiate new types of democracy-support and public diplomacy activities. These funds were promptly tagged as "regime-change" funds by the media in both countries and then by the Iranian Government. The National Academies have not accepted such funding for travel to Iran, although some Iranian security services may consider any type of U.S. government interest in activi-

ties in Iran as regime-change activities. Indeed, great care is needed as to how government funding is used lest it set back rather than promote achievement of both democracy-promotion and science engagement objectives.

Exemplifying the intersections of the roads to achieving different objectives, in December 2008, a staff member of the National Academies was detained and interrogated in a Tehran hotel for nine hours over a period of three days by Iranian security officials. He was falsely accused of attempting to foment a velvet revolution in collaboration with the U.S. Government. The officials stated that Iran was not interested in scientific exchanges; and therefore he should cease his activities in the country. While he was not arrested and was allowed to leave the country on schedule, this unwarranted behavior by the Iranian security services has raised serious questions about further cooperative programs in the country. As of mid-2010, the National Academies were awaiting assurances from appropriate authorities in Iran that such an incident would not be repeated. Until such assurances are provided, activities within Iran have been suspended while engagement activities are pursued in the United States and third countries.

Three years earlier, without advance notification, the Department of Homeland Security had revoked valid U.S. visas for about 40 Iranian professionals who had been invited to attend a celebration in California for alumni of Sharif University of Technology. Upon their arrival at the ports of entry in California, they were ordered to leave the country immediately. Some of the scientists who arrived at the San Francisco airport in the middle of the night were detained in nearby jails. There apparently were no accommodations to keep them at the airport awaiting their departure flights that would take them back to Tehran or to other destinations outside U.S. borders.

A direct relationship between the two incidents seems highly unlikely. However, both of these incidents underscore the importance of the governments of the two countries formally endorsing scientific exchanges as an important activity that will benefit both countries. In the absence of such public endorsement, the likelihood that engagement efforts of the National Academies, and probably other U.S. organizations, will increase is not high.

THE WAY FORWARD

The future direction of the program of engagement carried out by the National Academies is uncertain. At the level of individual scientists, there are conflicting views as to whether scientific exchange programs can be

effectively carried out without crippling interference by the security services in the two countries, given the current political environment. Nevertheless, most well informed scientists in the two countries with whom the National Academies have contacts favor continuation of engagement activities to the extent possible. They recognize that there may be personal risks, but they also believe there will be significant scientific and other rewards from engagement.

The scientific areas that might be considered for future cooperation are relatively easy to identify. Building on past cooperative endeavors should be a high priority in developing the next phase of cooperation. Also, future activities should more aggressively pursue the goal of self-sustainability of cooperative efforts. Self-sustainability means that following an event, or a series of events, organized by the National Academies, the participating scientists, with the support of their institutions, continue to pursue their personal interests in cooperative activities without indefinite dependence on the National Academies as the organizer of such activities.

Against the background of uncertainty as to whether and when to move forward and a rich agenda of topics that can be profitably pursued cooperatively, the National Academies are setting the stage for the next phase of engagement. Plans are under way to hold additional workshops in the United States and third countries. The Department of State is being encouraged to seek assurances from the Iranian government that harassment of American scientists visiting Iran will cease. Also, other ambitious pilot projects in the environmental field are being considered.

Iran's size, its geostrategic location, and its abundant energy resources ensure that the country will continue to be a very important political player in the region. But the Iranian Government is under both internal and external pressures concerning its policies, and an increasingly outspoken Iranian population is divided. Thus, there is a long road to agreement in Tehran as to the nation's future political direction, both internally and internationally.

Meanwhile, Iranian scientists sometimes say that science was in the DNA of the Persians and that the current generation of university students and young professionals has inherited a passion for science. The large number of well-trained scientists and doctors in Iran help document this conviction. The political neutrality of science can steer talented segments of the Iranian youth in their search for personal satisfaction and professional recognition in research laboratories for contributions to meeting national needs, even if jobs are scarce and salaries are low.

The technical and political benefits of science engagement can be rewarding for both countries. Science that improves economic and social conditions for the general population can offer rallying points for bringing parties together nationally and internationally without the need for major political compromises by any party. Indeed, science cooperation is one of the few options for bridging diverse interests of Iran and the United States and in establishing gateways to mutual understanding and to international security of global importance.

1

Introduction

During the late 1990s, the National Academies began exploring the opportunities for facilitating non-governmental engagement between American and Iranian scientists, engineers, and health professionals (herein referred to as "scientists," with science, engineering, and/or health referred to as "science"). The first formal step toward engagement was a visit to the National Academies by leaders of the Iranian Academy of Sciences and Academy of Medical Sciences in 2000. By 2002, significant engagement activities under the auspices of the National Academies had become a reality. Joint activities sponsored by the National Academies and a variety of Iranian partner organizations continued through 2009, with occasional short-term interruptions due both to unanticipated political concerns (e.g., Iranian objections to U.S. fingerprinting requirements at ports of entry, U.S. Department of Treasury denials of licenses required for selected activities) and to administrative difficulties (e.g., delays in processing visa approvals in both capitals, unanticipated competing commitments of key U.S. or Iranian participants in projects).

As discussed in Chapter 5, the National Academies intend to continue the program of joint workshops and to develop other types of engagement activities as well, depending on the political situation. The scientific themes of mutual interest as well as the feasibility of implementation have been under discussion in Washington and Tehran. At the same time, the future of the U.S.-Iranian governmental relationship that influences science engagement activities remain uncertain.

STATEMENT OF TASK

This report responds to the following Statement of Task, which was prepared by the leadership of the National Research Council in December 2009:

> *The report will document the history of the National Academies' cooperation with Iran over the past 10 years. It will describe the nature of the workshops, pilot projects, individual visits in both directions, continuing consultations, and types of relationships that have been developed and have flourished between U.S. and Iranian scientists, engineers, and health professionals during this period. It will comment on the significance and impact of the activities, practical considerations in carrying out activities, and opportunities for future work.*

Thus, the report looks both to the past and to the future. Of special interest are activities that can be undertaken to strengthen and build on the embryonic foundation for sustained scientific cooperation that began to form during the past decade. The evolution and characteristics of that foundation are significant themes of this report.

BROAD INTERESTS IN SCIENCE ENGAGEMENT

This report describes the most important components of the program of the National Academies to promote U.S.-Iran science engagement during the first decade of the 21st century. This engagement has been based primarily on the personal scientific interests of the U.S. and Iranian participants. More than 500 scientists from more than 80 institutions in the two countries have actively contributed to the jointly organized workshops and other types of exchanges.

However, these core participants are but a small portion of the scientists and others in the two countries who have been interested in the program. More than 500 other scientists from Iran and the United States have also met with exchange visitors. These other scientists have consulted with visiting specialists after guest lectures, during tours of educational and research facilities, and at receptions and other hospitality events. The overall number of scientists and students from the two countries who have attended guest lectures in person or via the Internet has been in the thousands. Also in Iran, hundreds of copies of reports of the activities—particularly Proceedings of

workshops published by the National Academies—have been provided to partner organizations for circulation to a number of interested readers.

Of special importance, government officials in Washington and Tehran endorsed in principle, and sometimes in detail, each of the joint activities before they were undertaken. They have included Secretaries of State and Ministers of Foreign Affairs who were briefed on the overall program and on near-term events. Reportedly, the Supreme Leader and two successive Presidents of Iran have taken a personal interest in some aspects of the program. More junior officials in both countries have had responsibilities for approvals of visas. Others have been involved in ensuring compliance of exchanges with regulations in the two countries.

A few influential political and scientific leaders in both countries have been outspoken advocates of the program. Some supporters have had long-standing interests in encouraging cross-border approaches for using scientific achievements to help address difficult economic, environmental, health, and other challenges of both local and international importance. Others have become newly minted advocates of exchanges based on their initial rewarding experiences with colleagues from a distant country. A number of Iranian-American supporters who have strong roots in both countries have long urged expanded science engagement. A few scientists in both countries have expressed their desire to the National Academies to participate in engagement efforts in order to contribute to positive changes in the U.S.-Iranian political relationship.[1]

THE SCIENTIFIC-POLITICAL NEXUS

The primary objective of the National Academies in the engagement effort has been to achieve scientific benefits for both sides and for the international scientific community more broadly. The activities have been designed to enable scientists from the two countries to share the benefits that can be derived from cooperation in science education, research, and applications. At the same time, the National Academies and their Iranian partners have attempted to keep the fields of cooperation outside the boundaries of national security interests, lest security sensitivities raise concerns about the overall purpose of the program and thereby make cooperation more difficult. Of course, at times these boundaries have been uncertain. Nevertheless, participants from both countries seem to have been reasonably confident that the activities have remained within the province of peaceful and appropriate uses of science.

While the focus of the National Academies has been on the scientific aspects of engagement, it has not been possible to insulate U.S.-Iranian exchanges from the strained relationship that has existed between the two governments for many years. At times, the linkages between non-governmental engagement and the bilateral political relationship have been quite obvious. They have been most evident during the process of gaining various approvals for specific activities when approvals have been necessary or desirable in Tehran and in Washington.

This political-scientific nexus will probably gain even greater importance in the near term as major steps toward political rapprochement continue to elude the two governments and as all aspects of the bilateral relationship are increasingly scrutinized in the two capitals. Of particular concern for the future of exchange activities are (a) expansion of the scope of U.N. and U.S. economic sanctions, and (b) continuation of harsh measures by the Iranian Government to control dissension following the 2009 election. Such developments may cause the National Academies and partner organizations in Iran to consider modifying or even scrapping some approaches to engagement that they have used successfully in the past (e.g., participation by exchange visitors in unscheduled private dinners without informing well in advance the formal hosts for the visits, who may have security-imposed requirements concerning *ad hoc* activities).

The National Academies and partner organizations in Iran have usually been optimistic that bilateral cooperation in science contributes to the evolution of more favorable environments in both countries for reaching agreement on bilateral or multilateral issues that are politically sensitive. To this end, plans for cooperation and on-the-ground activities involving both prominent scientists and academic leaders from the two countries, and at times younger scientists, have usually received favorable assessments within the governments of Iran and the United States, despite political disputes between the governments that dominated the newspaper headlines at the same time. In any event, hopes have been high among many scientists and some important officials in the two countries that the engagement effort will continue despite the rough waters ahead.

SCOPE OF REPORT

As previously noted, the report focuses primarily on specific science engagement activities. (See Table 1-1.) The report does not attempt to analyze (a) the evolution of the broader political, economic, and security

TABLE 1-1 Time Lines for Engagement Activities

Meetings between Academy Leaders from Both Countries
Washington (2000)
Tehran (2001)
Tourtour, France (2003)
Washington (2005)
Tourtour (2006)
Tehran (2007)
Tehran (2008)

Joint Planning Meetings
Earthquake Science and Engineering, Tehran (2002)
Food Safety, Education, and Energy, Tourtour (2003)
Food-borne Diseases, Tehran (2005)
Food-borne Diseases, Tehran (2006)
Cancer, Houston (2006)

Workshops
Ecology of Caspian Sea, Moscow (1999)[a] (preliminary workshop)
Experiences and Challenges of Science and Ethics, Bellagio, Italy (2002)
Higher Education, Tehran (2002)
Ecology of Caspian Sea, Ramsar, Iran (2002)
Water Conservation, Reuse, and Recycling, Tunis (2002)
Food Safety and Food-borne Disease Surveillance Systems, Tehran (2004)
Drought Forecasting and Management, Tehran (2005)
Roots and Routes of Democracy and Extremism, Haikko, Finland (2005)[a]
Science, Technology, and Future Development of Societies, Tourtour (2006)[a]
Research and Higher Education, Tehran (2007)
Science as a Gateway to Understanding, Tehran (2007)[a]
Food-borne Diseases and Public Health, Washington (2007)[b]
Energy Challenges, Tehran (2008)
Water Management, Irvine, California (2008)[b]
Seismic Performance of Adobe and Masonry Structures, Tehran (2008)
Improving Earthquake Mitigation through Innovation in Seismic Science (2009)[b]
Managing Environmental Crises, Haikko (2009)[a]
Science, Ethics, and Appropriate Uses of Technology, Tourtour (2009)[a]

Visits to Iran by Nobel Laureates
F. Sherwood Rowland, Chemistry (2000)
Joseph Taylor, Physics (2007)
Thomas Shelling, Economics (2008)
Burton Richter, Physics (2008)

Fields of Individual Travelers
To Iran
Science Policy
Science and Religion
Physics
Earthquake Science and Engineering
Geology
Epidemiology

To the United States
Science Policy
Science and Religion
Physics
Cancer
Drug Addiction
Political Science

Staff Consultations:
Annually 1999 to 2008 (All in Iran)

[a] Participants from Third Countries.
[b] Component of International Visitor Program.

relationship between the United States and Iran, or (b) internal unrest within Iran, including allegations in Iran that the United States has been using exchanges as one means of creating turmoil within Iran and thereby help foment a velvet revolution. Of course the bilateral relationship, which has been on a downward slide, and the volatile political situation within Iran have influenced engagement activities.

A number of U.S. policies are critically important for science engagement programs. For example, restrictions on exports, limitations on financial transactions involving Iranians and Iranian institutions, and requirements for licenses from the Department of Treasury for some activities were not designed, at least in the first instance, to control science engagement. But their reach now extends to encompass some types of such cooperation.

These and other important policies are briefly discussed, particularly in Chapter 1. However, the report leaves to others the detailed analyses of political and security challenges within and between the countries during the first decade of the 21st century.[2]

Other U.S. nongovernmental organizations have also supported science-related U.S.-Iran cooperative activities. Inventories of such programs have not been undertaken and made public—at least in the United States—since some organizations prefer not to publicize their activities. The most extensive U.S.-Iranian science-related programs in recent years have probably been those organized (a) by Iranian-American scientists individually, (b) by professional associations of Iranian-Americans, (c) by private firms interested in trade, (d) by the National Institutes of Health (NIH), which have consistently supported both Iranian researchers at NIH for one or two years and American scientists working with collaborators in Iran on projects of considerable scientific interest, and (e) by U.S. universities, with Iranian students and Iranian-American faculty members playing prominent roles.[3] Iranian-American scientists have also played significant roles in the activities of the National Academies.

In recent years important science-related events have been supported in Iran by a number of international organizations (e.g., UNDP, UNESCO, WHO, FAO, UNCTAD, UNIDO), development banks (e.g., the World Bank), and regional organizations (e.g., Economic Cooperation Organization based in Tehran). These events, together with reports by Iranian and foreign journalists, have been helpful in clarifying for the international community some of the science-related development challenges in Iran.[4] They have provided information within Iran and abroad on the strengths and weaknesses of organizational approaches of Iranian science and on specific technical

issues. They have documented the priorities within science that have been established by the Iranian Government. Also, they have highlighted the long and complex road ahead that could provide continuing access of Iran to international technological developments and to worldwide experiences in using these developments for economic and social progress. (See Appendices H and I for indicators of the extent of the Iranian research establishment and the enrollment in science in universities.) The international conferences have provided opportunities for American and other foreign specialists to travel to Iran and, while there, to become acquainted with developments at a few research, engineering, and medical facilities. The report draws on observations by some of the participants in these activities.

Finally, each year Iranian government and academic institutions also organize a number of large conferences, primarily in Tehran, that include discussions of scientific issues of international importance. Occasionally American specialists participate in these conferences, particularly Iranian-Americans. The National Academies have encouraged, but not supported financially, attendance at these gatherings, which attract many Iranian officials and international specialists in selected fields. They usually involve side visits to important institutions. Such opportunities are briefly discussed in Chapter 5.

AUDIENCE FOR THIS REPORT

A number of American and Iranian researchers, scientific leaders, and university administrators may be interested in this report. It highlights the types of cooperative activities and topical areas that have been of mutual interest in recent years. It provides insights as to the opportunities and pitfalls in organizing exchange activities.

U.S. government officials are also likely to be interested since some activities that are discussed overlap with U.S. government priorities for engagement. As of mid-2010, the U.S. government's interest in having multiple channels of communication with various segments of Iranian societies through exchanges remained strong. If activities are expanded when the post-election environment in Tehran becomes more favorable for exchange programs, the commentaries on the activities in this report should be helpful in developing future programs.

Finally, the report may be of interest to advocates of science diplomacy, foreign policy specialists, and science historians. With a few exceptions, the readily accessible English-language literature concerning the long history of

U.S.-Iranian cooperation in science is limited. Among the previous documentation are brief discussions of training of Iranian nuclear engineers in the United States, references to U.S. foreign assistance several decades ago, and reports of narrowly focused joint activities related to the Bam earthquake, dwindling biological resources of the Caspian Sea, archeological treasures of Persia, and medical achievements of Persia and then Iran. This report complements the writings of others with an up-to-date window for viewing some previously undocumented aspects of science-related developments in Iran, which have formed the basis for bilateral cooperation.

END NOTES

1. For strong endorsement of the concept of science diplomacy, see: Partnership for a Secure America, "Science Diplomacy Is Crucial to U.S. Foreign Policy," Washington, D.C., February 2010, *www.psaonline.org/article.php?id=620*.
2. Many books and reports have provided useful background concerning developments in Iran. They include, for example: Wilfried Buchta, *Who Rules Iran? The Structure of Power in the Islamic Republic,* Washington Institute for Near East Policy (in collaboration with the Konrad Adenauer Stiftung), Washington, D.C., 2000; Daniel Doktori et al., *Iran,* Journal of International Affairs, Columbia University, New York, Spring/Summer 2007; Keith Crane, Rollie Lal, and Jeffrey Martini, *Iran's Political, Demographic, and Economic Vulnerabilities*, The Rand Corporation, 2008; Middle East Institute, *The Iran Revolution at 30*, Institute Viewpoints, Washington, D.C., 2009; David E. Thaler et al, *Mullahs, Guards, and Bonyads: An Exploration of Iranian Leadership Dynamics*, The Rand Cooperation, 2010.
3. For more than a decade, the Iranian Academic Association, established in 1995 and headquartered in New York, was a particularly active organization in organizing workshops in Iran and the United States, facilitating student exchanges, and assisting with visas. Its activities overlapped in a number of ways the interests of the National Academies in fields such as traffic accidents, water resources and agriculture, and biomedical engineering. *www.IranianAA.org*.
4. For an insightful assessment of important components of the science and technology infrastructure of Iran, see United Nations Conference on Trade and Development, *Iran: Science, Technology, and Innovation Policy Review*, United Nations, New York and Geneva, 2005. An important conclusion in this report was that Iran's main concerns in science and technology were the following: (a) how to attract new entrepreneurs, (b) how to promote an innovation culture, and (c) what universities could do to promote innovation and entrepreneurship (Reference: United Nations Conference on Trade and Development, Trade and Development Board, TD/B/COM.2/69, GE.06-50005, January 5, 2006).

2

Initiating Engagement

The National Academies began their effort to engage Iranian institutions in scientific cooperation in 1999. The first formal interacademy meeting was held when Iranian academy leaders visited the National Academies in 2000. This initiative was undertaken against a background of occasional interactions between leading American and Iranian scientists at a variety of international forums. These forums included meetings sponsored by UNESCO, the World Health Organization, other U.N. organizations, and a number of nongovernmental organizations affiliated with the International Council of Scientific Unions.

As to the scientific strengths of Iran, which were to be critical components of engagement, the National Academies were aware of the successes of Iranian science and mathematics students in international competitions at both the university and secondary school levels. Also, reports of impressive achievements of Iranian graduate students, who had received their undergraduate training in Iran, at some of the best universities in the United States were frequent. Thus, expectations were high that engagement would be scientifically rewarding for the American as well as the Iranian participants even though the National Academies had few details on Iranian capabilities.

At the same time, great uncertainties concerning how to establish meaningful cooperative activities that would draw on Iran's strengths dominated discussions in Washington. In many ways the Iranian scientific community had been isolated from the mainstream of international science for a number of years. A well-known, but dormant, tradition of international

scientific outreach by Iran's strongest institutions during the 1970s needed to be revived.

The National Academies searched for opportunities for discussions, through intermediaries and directly with Iranian counterparts, which would clarify the scientific interests in non-sensitive areas of both the National Academies and their potential partners. Non-sensitive meant that any activity would be carried out within the legal and policy boundaries for interactions that had been established by the U.S. Government, and particularly the limitations imposed by export control regulations and economic sanctions. It quickly became clear that opportunities were available or could be developed for initial discussions about mutually beneficial bilateral engagement. Multilateral meetings provided good venues for such side discussions, but direct bilateral approaches that were not distracted by a focus on multilateral activities became preferable.

During the period of initiating engagement, a limited number of other U.S. institutions were cooperating in scientific endeavors with Iranian counterparts. The principal mechanisms included (a) university-to-university arrangements that usually involved student exchanges, (b) occasional U.S.-Iran workshops and other events in the United States and in Iran arranged by Iranian-American organizations, (c) attendance by a few American specialists at scientific conferences in Iran where contacts could be made with a variety of potential collaborators, and (d) acceptance by a limited number of Iranian scientists of invitations from American colleagues to participate in conferences in the United States. The experiences from these activities and from related efforts of several professional societies in the United States were helpful in providing guidance for the National Academies concerning how best to initiate and structure engagement activities and how to sustain such activities.

Despite concerns within the U.S. Government over Iran's record on human rights, support of terrorist organizations by the Iranian Government, and Iran's quest to acquire nuclear weapons, the Department of State supported the outreach efforts of American institutions to Iranian organizations in a number of fields, including science. Key U.S. government leaders had consistently argued that building long-term relationships with Iran should proceed in parallel with resolving immediate problems separating the two countries. This governmental support has been critical in the decisions of the National Academies to have a program that involved activities in both countries. Numerous meetings have been held with U.S. officials to help ensure that the program of the National Academies would

complement and not complicate other engagement activities of interest to the U.S. Government.

COMMON INTERESTS IN HALTING DEGRADATION OF THE CASPIAN SEA

In the spring of 1999, a staff member of the National Academies accepted an invitation from the Institute for Political and International Studies (IPIS) in Tehran to make a presentation at a conference at the institute on developments in the Caspian Sea region.[1] By coincidence, at about the same time, the National Academies and the Russian Academy of Sciences decided to hold a workshop on the ecology of the Caspian Sea in Moscow in December 1999. The two academies planned to include Iranian specialists in the workshop if possible, as well as specialists from other littoral nations that bordered the sea and from the United States. Thus, the staff visit to Tehran provided an opportunity for a meeting with the leaders of the Iranian Academy of Sciences and for extending to them an invitation for Iranian participation in the Moscow workshop. The Iranian Academy promptly accepted the invitation.

Three Iranian scientists attended the workshop in December 1999. Each presented a paper, and they actively participated in the discussions and in the informal events associated with the workshop. Most importantly, they expressed a strong desire to continue and expand interactions with American colleagues, which were not possible through other channels.[2]

Initially, the American participants were skeptical that the workshop would break new ground. The Global Environmental Facility (GEF) of the World Bank had already initiated a major assessment of the environmental problems that were rapidly degrading the Caspian Sea. In particular, the GEF gave high priority to assessing the increased pollution of the sea and the decline in fishing stocks. At the Moscow meeting there was some repetition of previous GEF discussions. However, the workshop focused more sharply on scientific aspects of the degradation of the sea and the seemingly irreversible ecological damage. The consensus among participants in Moscow was that the workshop was very useful not only in highlighting the need to slow down the rapid decline in the quality of the water and the seabed but also in giving additional scientists seats at the table of international ecological discussions directly related to their research activities.

In setting the stage for development of bilateral cooperation between the National Academies and the Iranian Academy of Sciences, the staff visit to Tehran and the Moscow workshop were important early steps that opened

scientific communication. This communication has continued without interruption until the present. The many discussions at workshops subsequently organized by the academies of the two countries have built on these initial activities, which demonstrated that cooperation was of interest to scientists in the two countries. The Iranian Academy of Sciences was particularly impressed by the rapid publication and distribution of the Proceedings of the Moscow workshop in both English and Russian and by the interest in Iran in the Proceedings.

VISITS OF ACADEMY LEADERS IN BOTH DIRECTIONS

Meanwhile, the Federation of American Scientists (FAS) had sent a small team of scientists to Iran in early 1999 to discuss possibilities for bilateral scientific cooperation. The FAS focused the team's attention on the activities of the Iranian Academy of Sciences, with additional interest in the role of the Academy of Medical Sciences. The FAS invited the leaderships of the two academies to Washington in the fall of 1999, and then the FAS turned to the National Academies to assist in hosting the visitors. During the visit to Iran of the member of the staff of the National Academies discussed above, he encouraged Iranian acceptance of the FAS invitation. In particular, he discussed the arrangements that would be made in Washington for receiving the visitors at the National Academies.

The Iranian visitors arrived in Washington in September 1999. The group included the President of the Iranian Academy of Sciences and the Vice President of the Academy of Medical Sciences. Very general discussions were held at the National Academies about the importance of international cooperation to advance science, engineering, and medicine. All participants embraced the concept of a program involving bilateral exchanges of scientists who were working in fields of mutual interest. As the next step, the Iranian leaders extended an invitation for a visit by the leadership of the National Academies to Iran.

In September 2000, a delegation of leaders of the National Academies, including the presidents of the National Academy of Sciences and the National Academy of Engineering and the Foreign Secretary of the Institute of Medicine, traveled to Tehran, Esfahan, and Shiraz. Their visit was well publicized in Iran, and the reception was cordial everywhere. The substantive discussions in Tehran and Esfahan provided interesting insights into the roles of universities and research institutions in Iran. Similarities with approaches in the United States were striking.

In Tehran, considerable emphasis was given to the seismic situation and concerns over the likelihood of a catastrophic earthquake that could cause great damage in Tehran. A second topic of interest was protection of the environment, and particularly better control of air pollution problems in Tehran and stronger measures for protecting the marshes along the southern coast of the Caspian Sea. The Minister for Environment, her staff, and their associates devoted considerable time to briefing the delegation members on these and other issues. The presence of Nobel Laureate F. Sherwood Rowland on the delegation attracted considerable admiration from the Iranian scientific community. His meetings with faculty members and graduate students who were focused on the details of ozone depletion were of particular interest to the Iranian hosts.

In Esfahan, following meetings at two universities, the delegation was introduced to the realities of developing democratic governance in the city. A meeting with the first elected Mayor and first City Council, which included as members a number of university professors and medical doctors, became a lengthy session on how to manage and distribute an annual city budget of $40 million. Utility services, educational opportunities, and trash collection were among the topics on the lists of concern of the council members. The meeting included comments on the desirability of a U.S.-Iran sister-cities program, which could readily involve universities and medical facilities. While Esfahan was already twinned with several other sister cities in Europe, none of these cross-boundary programs had amounted to a serious effort by the European cities to engage with Iranian counterparts, according to the Iranian hosts. Also, during the discussions, the increasing influence of the quasi-independent media in Iran was underscored by comments of a journalist who had just lost his credentials for expressing opposition to policies in Tehran but who was in the process of receiving new credentials with a different news service.

During the visit, the academies from both countries developed a joint list of topics for focusing future cooperation. Thirteen topics, which are set forth in Appendix A, were identified as appropriate for workshops. In subsequent years, joint workshops addressed seven of the topics. Exchange visits involving young investigators were also considered, but these did not materialize as the academies in both countries relied on more seasoned specialists to participate in joint activities. While visits of individual senior scientists were not singled out as a priority, they were discussed and later became an important component of the cooperation. Finally, the academies agreed to work to reduce barriers to scientific cooperation, with a particular

focus on visa problems. The academies have been struggling with reducing barriers ever since.

The participation in the delegation of the director of the human rights program of the National Academies seemed to raise considerable interest among some Iranian participants. Discussions with scholars, human rights advocates, and an interested Iranian journalist were quickly scheduled. The hope on the part of the National Academies was that these contacts would lead to more active involvement of the leaders of the Iranian academies in the International Human Rights Network of Academies and Scholarly Societies. This hope did not materialize to the extent anticipated. However, a member of the Iranian Academy of Sciences attended the next meeting of the Network and the director of the jointly sponsored United Nations and Tehran University Center for Human Rights gave a lecture at the meeting.

More than a dozen well-known Iranian government and clerical personalities, in addition to Iranian scientific counterparts, attended an elaborate evening reception for the visitors. These Iranian leaders were ready to discuss, at least briefly, political and economic developments that intersected with international science. While the engagement activities that eventually developed did not focus on political and economic issues, such issues were often considered at workshops and in less formal settings.

Finally, throughout the visit, leading Iranian scholars in Islamic studies participated in the discussions. They were instrumental in placing on the agenda for future consideration the topics of ethics and religion as they related to science. Indeed, the first joint workshop that was held after the visit was on science and ethics and is discussed in Chapter 3.

PREPARATIONS FOR IMPLEMENTING AGREED PROGRAMS

With agreement having been reached on a framework for collaboration, the challenge was to organize and carry out specific activities. On the U.S. side, commitments were made by interested scientists, funding was secured, and OFAC licenses for the workshops were obtained, usually with delays of 4-6 months. The Iranian side presumably had parallel challenges. More than one year was required to put in place the organizational machinery for collaboration. Finally in 2002, professional interactions began, with four workshops held in that year as discussed in Chapter 3.

Chapters 3 and 4 describe the most important cooperative activities that have taken place through the end of 2009. Organizing events involving Iranians has not been easy; and for every event that has been held, at

least one event that was proposed by one side and accepted by the other has not materialized. Thus, both sides considered that the holding of four workshops in a single year was indeed a monumental achievement, and the initial workshops sent an excellent signal to scientists in both countries that serious collaboration had begun.

END NOTES

1. Glenn E. Schweitzer, "Measuring the Security Impacts of Environmental Degradation of the Caspian Sea," *Abstracts, Seventh International Conference on Central Asia and the Caucasus. The Caspian Sea: Opportunities and Obstacles*, Institute for Political and International Studies, Tehran, June 22-23, 1999, p. 54.
2. A.V. Frolov and M.G. Khublaryan, editors, *Ecological Problems of the Caspian Sea*, Russian Academy of Sciences (in cooperation with the National Academy of Sciences), Moscow/Kirov, 2000.

3

Workshops

Workshops have been the core of the US-Iran engagement program of the National Academies. Seventeen workshops were held from 2002 through 2009. Nine took place in Iran, and eight were held in the United States and in third countries. In addition, the National Academies assisted other organizations in arranging two U.S.-Iran workshops. More than a dozen workshops that were proposed by the National Academies or counterpart organizations in Iran were postponed or cancelled during the planning process due either to (a) selection of other topics for workshops that were considered of higher priority by one side, or (b) administrative complications.

Twelve of the seventeen workshops involved specialists only from the United States and Iran, while five included participants from other countries as well. Four of the five workshops were held in third countries where the French Academy of Sciences and the University of Helsinki served as hosts. They invited specialists from their own and other countries who quickly became important participants in the events. The fifth multilateral workshop, which was held in Iran, included several specialists from Europe and Africa who were visiting Iran as guests of the workshop organizers.

The presence of third country participants in the workshops did not seem to affect the quality or candor of the presentations and discussions during the workshops. Understandably, the presentations by these participants were not directed to the U.S.-Iranian scientific relationship. However, broadening the discussions beyond this relationship at times added important

perspectives on the technical issues and the associated political and social contexts under consideration.

Workshops usually were designed to include six to ten prepared presentations by American participants and a comparable number by Iranian participants. The multilateral workshops were organized to include a larger number of presentations since specialists from other countries were also invited to make presentations. However, due to personal travel problems and unanticipated developments, the number of in-person presentations varied considerably. On several occasions, papers were submitted by specialists who were unable to attend; and these papers were distributed to attendees. A few of these papers were included as appendices to the Proceedings of the workshops. The minimum number of in-person Iranian presentations at a single workshop was two (on one occasion), and the maximum was 30. The minimum number of American presentations was two (on one occasion), and the maximum was 15.

Proceedings, which included the texts of the presentations, were prepared for most of the workshops and published without restrictions on distribution. While preparation of the Proceedings took considerable effort, they have provided a useful record of most of the workshops. Some copies have been distributed to requesters many years after they were published. Published Proceedings are identified throughout this chapter and in Appendix G.

Set forth below are comments on the various workshops. The workshops are clustered under general topics. An important criterion in selecting topics for workshops has been ensuring a symmetry of interests and capabilities. Each side has been expected to bring ideas to the table so that neither side dominates discussions. When appropriate, descriptions of follow-on activities are included in the discussions throughout this chapter. Chapter 5 addresses scientific and political impacts of the workshops and other events, beyond those mentioned in this chapter, to the extent that impacts can be ascertained or anticipated.

FOOD-BORNE DISEASES

Food security/food safety was identified as a potential workshop topic by both sides at the outset of the program in 2000. However, during a joint planning session on the workshop program in 2003, specialists from Iran and the United States decided that this topic was simply too broad for a single workshop or even a workshop series. They agreed to focus initial joint efforts on food-borne diseases, with disease surveillance and responses to food

contamination incidents as important themes. Workshops that emphasized these themes were eventually organized in Tehran and Washington.

The workshop in Tehran involved more than 100 Iranian specialists from more than 15 organizations, all of whom received Iranian certificates for their participation. At the time, the Iranian Government was giving high priority to the topic of food-borne diseases as indicated by the participation of many Iranian government scientists who considered that this workshop was important. (See Box 3-1 concerning the interest of one Iranian government department.) Among the topics emphasized at the workshop were specific diseases of concern, disease surveillance, inspections of facilities, risk analysis, and hazard analysis and critical control points.[1]

Following the workshop, the American participants visited Shaheed Beheshti Medical University, the Pasteur Institute including its research complex and its new biotechnology laboratories, and three slaughterhouses that had just been privatized. According to the Iranian hosts, the visitors were the first Americans to visit several research laboratories. The Iranian and American participants subsequently decided to launch a cooperative pilot project to upgrade disease surveillance in northeast Tehran. (See Chapter 4.)

The Iranian participants in the second workshop held in Washington, D.C., included both senior scientists and young researchers. The major topics were disease surveillance, gastrointestinal diseases, risk assessment, associations between food-borne diseases and chronic diseases, and health education. Of special interest were reports on research activities resulting from the first workshop (see, for example, Box 3-2) and on the collaborative

BOX 3-1

At a time when globalization, self regulation, hazard analysis, and quality control have become so important, Iranian food safety principles incorporated in regulations are considered as urgent national priorities.

S. Farzad Talakesh and Hamid Khanaghahi,
Iran Veterinary Organization, October 2004.[a]

[a]National Research Council, *Food Safety and Foodborne Disease Surveillance Systems, Proceedings of an Iranian-American Workshop*. Washington, DC: National Academies Press, 2006, p. 64.

BOX 3-2

One result of the 2004 workshop was the establishment of a reference laboratory for the identification, isolation, and culture of relevant bacterial food-borne pathogens at the Research Center for Gastroenterology and Liver Disease at Shaheed Beheshti Medical University. Later, the Center expanded its activities to include work on various viruses and parasites.

Mohammad Reza Zali,
Shaheed Beheshti Medical University, November 2007.[a]

[a]Institute of Medicine, *Food-borne Disease and Public Health, Summary of an Iranian-American Workshop*. Washington, DC: National Academies Press, 2008, p. 6.

disease surveillance pilot project in Iran, which is discussed in Chapter 4.[2] Following the workshop the Iranian visitors met with specialists at relevant facilities in the states of Georgia, Washington, and Oregon and in the Washington, D.C. area.

WATER CONSERVATION

Workshops on water issues have been high on the priority lists of both the Iranian Academy of Sciences and the National Academies throughout the past decade.

Unfortunately, plans for the first workshop were foiled at the last minute. While representatives of the National Academies awaited the arrival of the Iranian delegation of specialists in Los Angeles, the leader of the Iranian group telephoned Washington from Tehran saying that the group had been instructed not to board the Iran Air flight that evening. The U.S. government's requirement for fingerprinting Iranians was unacceptable to Iranian officials. After a six-month delay, the workshop was rescheduled for Tunisia where arid land conditions were similar in some respects to conditions in Iran and where visas and entry into the country would not be a problem for Americans or Iranians.

The workshop in Tunis was the first of three workshops directed to more effective use of limited water resources. A second workshop was held in Iran. The third workshop was organized in Irvine, California. As an example of

the importance of this topic in Iran, the seriousness of the water problems for agriculture is indicated in Box 3-3.

The first workshop resulted in agreement among the participants that four critical problems concerning water management were the following:

- forecasting and managing effects of droughts,
- developing technology for inexpensive recycling of urban wastewater without adverse impacts on public health,
- improving the economic efficiency in using water in agriculture, and
- developing new and innovative institutional arrangements for managing water, consistent with historical antecedents and traditions of each country.[3]

Following up the discussions during the first workshop, the participants addressed the following topics during the second workshop, which focused on droughts:

- drought monitoring and evaluation,
- early warning and action plans for coping with droughts,
- risk management and crisis management during droughts,
- assistance programs during droughts,
- evaluation of water scarcity,

BOX 3-3

Drought is an inevitable event that occurs on and off with no clear warning. Sometimes it lasts only a year, but the southern and eastern parts of Iran are now experiencing the ninth consecutive year of a severe drought period. Drought causes losses in millions of dollars for many farming communities.

Amin Alizadeh and Medhi Nassiri-Mohallati,
Ferdowsi University, May 2005.[a]

[a] Ali Reza Sepaskhah, *Drought Forecasting and Management, Proceeding of an American-Iranian Workshop,* Iranian Academy of Sciences and Iranian Ministry of Agriculture, 2006, p. 6.

- preparation for droughts: technical, organizational, legislative, training, and research requirements, and
- institutional relationships.[4]

The third workshop addressed urban, agricultural, and environmental uses of water. While the workshop was considered very useful by both Iranian and American participants, the ten-day tour by the Iranians of facilities in Southern California and Arizona that took place before and after the workshop was exceptionally well received despite the blistering August heat. The Iranian specialists were particularly impressed by the modern facilities that control water flows, the water management systems in operation throughout the region, and the attention given to the dependence of environmental quality on adequate water supplies.

The workshop participants identified the following areas for development of parallel research projects in the two countries:

- optimal ground water management, particularly in coastal aquifers and urban aquifers,
- water quality and management of sediment in irrigated agriculture,
- optimal water use for agriculture in semi-arid environments,
- new technologies for augmenting and enhancing water re-use, and
- adequate and accurate water resources data, particularly for evaluation of the high-resolution real-time satellite precipitation measurements from the PERSIANN system. [5,6]

EARTHQUAKE SCIENCE AND ENGINEERING

Two workshops were held that highlighted achievements and challenges in seismic science and engineering, which for many decades have been priority concerns in Iran, California, and many other areas of the world. (See Box 3-4.)

From a geoscience perspective, Los Angeles and Tehran have a number of similarities. (See Box 3-5.) Each is bounded by mountains rising above fertile alluvial slopes and arid sedimentary plains. Their seismic geographies are being actively shaped by folding and faulting in the bounding zones between gigantic tectonic plates. However, Tehran has many of its tall buildings in the foothills to the north whereas the tall buildings in Los Angeles do not extend into the foothills.[7]

BOX 3-4

During the twentieth century, the Iranian people experienced at least one earthquake of magnitude 7 or greater every seven years with more than 164,000 people killed. . . . The catastrophic earthquake at Bam effectively destroyed the ancient city with a population of 150,000. The number of deaths will perhaps never be known but is thought to be between 26,000 (the official figure) and 40,000.

Manouchehr Ghorashi,
Tehran Research Institute for Earth Sciences, June 2009.[a]

[a]PEER Center, *Improving Earthquake Mitigation through Innovations and Applications in Seismic Science, Engineering, Communication, and Response, Proceedings of a U.S.-Iran Seismic Workshop,* University of California, Berkeley, October 2009, p. 31.

BOX 3-5

From a geoscience perspective, Los Angeles and Tehran are remarkably similar. Each is bounded by high mountains rising thousands of meters above fertile alluvial slopes and arid sedimentary plains, their stunning but seismic geographies are being actively shaped by folding and faulting in the boundary zones between gigantic tectonic plates.

Thomas Jordan,
University of Southern California, June 2009.[a]

[a]PEER Center, *Improving Earthquake Mitigation through Innovations and Applications in Seismic Science, Engineering, Communication, and Response, Proceedings of a U.S.-Iran Seismic Workshop,* University of California, Berkeley, October 2009, p. 15.

The first workshop in Tehran, with participants from 14 Iranian institutions, addressed adobe and masonry vulnerability because of the extensive damage from earthquakes in recent years, and particularly the damage in Bam in December 2003. Of special interest was the need for seismic rehabilitation of over 27,000 school buildings and reconstruction of the Bam Citadel using surrogate adobe materials. Directions for future research collaboration were identified.[8]

The workshop was followed by (a) a one-day public seminar on seismic hazard reduction with over 100 participants, and (b) visits to several Iranian facilities. Topics for the seminar included education and public safety, earthquake loss reduction, seismic research in the United States, rehabilitation of schools and hospitals, and evolution of masonry as a structural material. The visits included discussions at Sharif University of Technology, the Geophysics Institute of the University of Tehran, and the International Institute of Earthquake Engineering and Seismology.

The second workshop in Irvine, California, had a wide-ranging agenda. Topics included seismic hazards, research and risk reduction, risk reduction and recovery, masonry and adobe buildings, seismic responses of buildings, and geotechnical earthquake engineering. Of special interest for the Iranian visitors was a detailed report on the Great Southern California ShakeOut, an earthquake rehearsal involving more than five million Californians. The objectives of the ShakeOut focused on (a) consistent messages, (b) visual reinforcement of messages, (c) discussions of contemplated actions, and (d) emphasis on specific actions. The importance of careful examination of engineering approaches to limit damage was another topic of considerable interest. (See Box 3-6.) Particular concern was expressed about the possibility that an earthquake could destroy bridges and buildings in Tehran. Also, during the workshop, technical topics for further cooperation were set forth together with a proposed organizational framework for cooperation, which included branches to many institutions in Iran and the United States.[9]

BOX 3-6

Much effort should be directed toward identifying the seismic vulnerability of buildings and retrofitting them. If the building is found to be seismically vulnerable, different retrofitting options should be carefully studied. Improper selection of retrofitting schemes causes waste of much needed financial resources and risks the lives of inhabitants in earthquake-prone regions.

[a]A.S. Moghadam, International Institute of Earthquake Engineering and Seismology, June 2009. Sharif University of Technology, *Seismic Performance of Adobe and Masonry Structures: Proceedings of the First U.S.-Iran Seismic Workshop*, Tehran, 2010, p. 149.

SCIENCE, ETHICS, AND APPROPRIATE USES OF TECHNOLOGY

The first U.S.-Iran workshop in 2002 was devoted to science and ethics. A workshop in 2009 considered science, ethics, and appropriate uses of technology. In between, ethics were raised at other workshops and planning meetings. This topic clearly was of great interest to many participants in the engagement program from the United States, Iran, and third countries.

At the first workshop, breakout groups on research integrity, environmental equity, ethics in medicine, and ethics and education proposed more than two dozen areas for future cooperation. Examples are as follows:

- integration of ethical values into the curricula for K to 12 education, and exchanges directed to the teaching of ethics at all levels of education,
- preparation and dissemination of reports on ethical issues confronted by scientists and engineers, and
- exchanges concerning ethical issues associated with food safety and environmental pollution (particularly cancer-causing chemicals).[10]

Many differences in the approaches to ethics in the two countries were pointed out by the participants. (See, for example, Box 3-7.) The discussions were lively and provocative. Following the workshop, some of the partici-

BOX 3-7

The Iranians considered ethics to be based on absolutes from which standards of conduct are derived for particular activities. The quality of the will of researchers is the basis of all choices. There was no consensus among the Iranians, however, as to what are the absolutes. The Americans noted that the baselines for judgments are not precise; and, therefore, they have not adopted this approach.

Mehdi Bahadori,
Iranian Academy of Sciences, and
George Bugliarello,
New York Polytechnic, April 2002[a]

[a]National Research Council, *Experiences and Challenges of Science and Ethics; Proceedings of an American-Iranian Workshop*, Washington, DC: National Academy Press, 2003, p. 4.

pants remained in touch by e-mail. Of special follow-on interest were the parallel efforts of the Iranian Academy of Sciences and the U.S. National Academy of Engineering to prepare documents on the ethical responsibilities of engineers, which could be used in educational materials.

Also, an Iranian participant in the workshop subsequently obtained from the World Health Organization a grant to support a survey of the views of theologians, doctors, and scholars in the Tehran region on ethical issues facing the medical community. The survey results underscored the importance of forming ethics committees at medical universities. The results suggested that policy officials should give greater attention to bioethics issues through expansion of consulting services, training of practitioners, and appropriate legislation.[11]

During a visit to Iran by several leading members of the National Academies in 2007, Sadegh Vaez-Zadeh, at that time the Iranian Vice President for Science, proposed that scientists of the two countries organize a program that would emphasize the responsibility of scientists to help ensure that irresponsible scientists do not divert modern technologies developed for economic and social advancement to military, criminal, or other inappropriate uses. His proposal led to the workshop in 2009 that emphasized appropriate uses of technology. Three types of technologies were given particular attention. They were biotechnology, nanotechnology, and cyber technology.

The workshop participants decided to prepare a brief Statement expressing the consensus of the personal views of the participants rather than preparing a Proceedings of the workshop. The Statement is set forth in Appendix F. The Statement emphasized "the results of scientific research are a common heritage of humankind and, as a general principle, should be openly available to serve all people equally. Scientific openness and freedom of inquiry are essential to the advancement of science itself. While some secrecy in the contexts of private intellectual property or national security is inevitable, these should be exceptions, and not the rule." The Iranian participants announced plans to introduce the Statement into international discussions on "the misuse of science," including discussions being organized by the International Association of Universities.

SCIENCE AND SOCIETY

Related to the workshops explicitly devoted to ethical issues were discussions at other workshops conducted under the broader title of Science and Society. This broader theme was used as an umbrella for addressing many

concerns of scientists in the two countries about the relationships between science and governance, science and education, and science and economic advancement. (See, for example, Box 3-8.) According to some of the participants from the two countries, this broader umbrella mirrored approaches for stimulating conversations in many forums in Washington and Tehran.

The first workshop under the title Science and Society covered a wide range of topics: communications within societies, morality, economic development, trends in basic sciences, technology to improve health and water availability, scientific thinking among decision makers, and school teachers and science. Two presentations that included important information, which had not been previously available to the American participants, were a brilliant paper about introducing new approaches to science education at the primary and secondary school levels in France (see Box 3-9) and an insightful analysis of trends in Iranian publications (see Box 3-10).

During a visit to the National Academies in 2005, which is described in Chapter 4, former Iranian President Mohammad Khatami suggested that the National Academies engage in a dialogue with Iranian specialists who are concerned with the future relationships among different societies. During subsequent discussions in Tehran, arrangements were made for a workshop that recognized the important role of science as a bridge in bringing together specialists from Iran and the United States to address cultural divides. A workshop on the topic Science as a Gateway to Understanding was held in Tehran in October 2007. (See Box 3-11 for a provocative viewpoint.)

A mix of philosophical, historical, and science-based presentations followed. The discussions were extensive as participants explored the details of

BOX 3-8

The range of scientific and technological opportunities and discoveries will continue to require careful ethical judgments which should be independent of preconceived political and theological ideologies.

Kenneth Shine,
University of Texas, June 2006.[a]

[a]National Research Council, *Science and Technology and the Future Development of Societies, International Workshop Proceedings*, Washington, DC: National Academies Press, 2008, p. 38.

BOX 3-9

Teachers with minimal training in science ask: Is science easy or difficult? Open or closed? Good or bad? Necessary for development or useless? Their answer is almost always the same: Science is difficult and in fact too difficult to be taught. "Science is definitely too difficult for me," is a sentence I have heard hundred of times. Contrary to the fear of many school teachers, there is no initial gap that must be overcome before entering into science. One must just want to take a walk with the students and enjoy it.

Yves Quere,
Academy of Sciences of France, June 2006.[a]

[a]National Research Council, *Science and Technology and the Future Development of Societies, International Workshop Proceedings*, Washington, DC: National Academies Press, 2008, p. 81.

BOX 3-10

Since 1993, the publication rate of Iranian scientists in Institute of Scientific Information (ISI) journals has skyrocketed. . . . It is not surprising for Iran to have experienced rapid economic growth since 1993, which correlates well with its rapid publication rate.

Mojtabe Shamsipur,
Rezi University, June 2006.[a]

[a] National Research Council, *Science and Technology and the Future Development of Societies, International Workshop Proceedings*, Washington, DC: National Academies Press, 2008, p. 65 .

the different perspectives reflected in the presentations. (See Box 3-12 for an example of an important viewpoint.)

PREVENTING AND RESPONDING TO CRISES

Comparative experiences of different countries in coping with the build-up of impending crises that affect large populations have long been of interest to scholars in many fields. The social sciences can play important

BOX 3-11

Modern science and the miracles of technology increasingly widen the gap between those in authority and those who are disadvantaged in the same way that religion, philosophy, communications, and other inventions of man's creative mind have been misused for the advancement of the powerful.

Mohammad Khatami,
Former President of Iran, October 2007.[a]

[a]National Research Council and Iranian Institute for Advanced Studies in Basic Science, *Science as a Gateway to Understanding, International Workshop Proceedings*, Washington, DC: National Academies Press, 2009, p. 5.

BOX 3-12

It is not the epistemological part of science that is important and brings understanding, but it is its social institutions that bring people together and make them talk about the things they have discovered or the things they plan to do. The scientific institutions are a key mechanism in bringing about understanding among different people.

Hyadi Khajehpour,
Sharif University of Technology, October 2007.[a]

[a]National Research Council and Iranian Institute for Advanced Studies in Basic Science, *Science as a Gateway to Understanding, International Workshop Proceedings*, Washington, DC: National Academies Press, 2009, p. 150.

roles in analyzing root causes and in identifying approaches to mitigate adverse consequences. Two workshops involving American, Iranian, Finnish, and other specialists—held in Finland—were devoted to crises of broad international concern.

The first workshop in October 2005 was a broadly based dialogue on the development of democracy in countries with large Muslim populations. Specialists from several countries reported developments in the region. Also, leading Finnish experts provided their views on relevant trends. For example,

they contended that contemporary Islamist political movements in the Arab world share the following major characteristics:

- They are critical of prevailing societal conditions in their world described as decadent, underdeveloped, or unjust.
- They blame authoritarian ruling elites for these conditions and therefore consider political change as the first crucial step toward betterment.
- They legitimatize their practices by rooting them in religious norms and values which serve as the ultimate ideological form of reference for society and politics.[12]

The second workshop in September 2009 focused on crises due to inadequate environmental management. Many environmental problems that confront Finland, Iran, the United States, and other counties were discussed. The responses to these problems should be of considerable interest to the international community.

The challenges in Iran include:

- restoration to the extent possible of the marshland on the Iran-Iraq border,
- steps to reduce the extreme dust storms that encompassed Tehran during 2009 and may continue due to the uptake of sand hundreds of miles to the west,
- measures to limit eutrophication of the Caspian Sea,
- curbing urban air pollution that is intensifying throughout the country,
- conserving energy usage in buildings and increasing use of renewable energy sources, and
- strengthening the roles of environmental nongovernmental organizations.[13]

The papers that were presented at the second workshop in 2009 should help focus international attention on common concerns about environmental challenges which are rapidly spreading. They help set the stage for more detailed consideration of a variety of issues of concern not only to Finland, the United States, and Iran, but also to the broader environmental communities throughout the world.

ECOLOGY AND ENERGY

An early workshop in Iran focused on the Caspian Sea and had an ecological theme. Held in 2002 on the southern shore of the sea, it pursued some of the same issues that were considered in the multilateral workshop on ecological issues of the sea three years earlier in Moscow, which is discussed in Chapter 2. However, the 2002 workshop was bilateral, focusing sharply on the environmental problems that directly affected Iran.

The Iranian Academy of Sciences had just begun a project on evaluation of information concerning the southern coast of the Caspian Sea. Therefore, the workshop was timely. However, to some of the participants there seemed to be a disconnect about the seriousness of degradation of the sea as perceived by the Iranian Academy of Sciences and the less urgent perspective of the environmental ministry of the country, which was not strongly represented at the workshop even though it was responsible for pollution issues. As was common at the time, many of the discussions about the Caspian Sea focused on (a) the decline in sturgeon and other fishery resources, and (b) the legal rights of the riparian states on access to the seabed, to the fishery resources, and to the airspace of the sea—issues which still remain unresolved.

The workshop addressed long-term as well as short-term ecological issues as indicated in Box 3-13. The details of the scientific issues were of course unique to the Caspian Sea. However, they were the same types of issues that are confronted when addressing other biologically rich bodies of water

BOX 3-13

Conservation and management of the Caspian Sea's biological resources can only benefit from acknowledging that species interact and that the presence of strongly interacting species demands particular attention. . . . Determining the outcome of the complex relationship between sturgeon, kilka, zooplankton, and the bethnic assemblage will require data on stock densities, rates of prey removal, and consumer population growth, at the least.

Robert Paine,
University of Washington, November 2002.[a]

[a]M. Sohrabpour, editor, *Proceedings of a Workshop on Ecology of the Caspian Sea,* Academy of Sciences of Iran, 2004, p. 35.

that are under stress from pollution and overfishing. Indeed the loss of biodiversity is a global problem.

Several years later in April 2008, Sharif University of Technology organized a small workshop on energy challenges, including environment implications, during the visit to Iran of Nobel Laureate Burton Richter, which is described in Chapter 4. The Iranian specialists presented assessments of Iranian supplies of and demand for various types of energy. This was done within the global context of requirements for access to energy resources. Climate change was also on the agenda.

There was an exchange of views on the future development of the oil and gas industries of the country, the outlook for developing renewable energy, and the opportunities to improve energy efficiency and conservation measures in buildings. The subsidies provided for gasoline, which encouraged excessive vehicular traffic, were decried by some participants as misguided, given the poor state of the refinery sector in Iran. Also, Iranian buildings were not constructed with energy efficiency in mind. Therefore, retrofitting buildings will be difficult; and convincing investors to spend more money on improving energy efficiencies in new buildings will not be easy.

EDUCATION AND RESEARCH CHALLENGES

As already noted, education was a popular issue throughout the history of the workshop program. Almost every topic that was considered for a workshop had an educational dimension. Since most of the participants in the program had appointments at either U.S. or Iranian universities, their interests in education were quite appropriate. Also, a number of universities in both countries have commanded considerable respect, and common interests in education helped avoid potential controversies over other issues.

An early workshop in 2002 was devoted to higher education. It took place at Payame Noor University, which has been the primary distance education center in the country, with dozens of branch offices in many regions. Thus, much of the discussion was devoted to distance learning although the American participants had anticipated a broader agenda and were not fully prepared to present a number of recent developments in the United States on this topic. Nevertheless, they were able to discuss trends that were common at a number of U.S. universities. The reason for the emphasis on distance education is set forth in Box 3-14.

Payame Noor University had not introduced electronic transmissions into its program at the time of the workshop. Standardized text were prepared

BOX 3-14

The rather short history of distance education has resolved a number of substantial problems in our country's higher education. Among these problems are the limited admission capacity of traditional universities, inflexibility of learning and instructional time allocations, and excessive expenditures of conventional universities compared to distance education.

Hashem Fardanesh,
Payame Noor University [a]

[a] Academy of Sciences of Iran, *Proceedings of a Workshop on Higher Education.* Tehran, 2004, p. 57.

and distributed to the branch offices where instructors led classes. However, Sharif University of Technology and other Iranian universities were in the process of introducing electronic systems which would link on-campus lectures with off-campus students. An important view on the role of information technology in distance education is set forth in Box 3-15.

Several years later, in 2007, a workshop that emphasized research in higher education was organized in Tehran during a visit of leading members of the National Academies. The workshop was held at Sharif University

BOX 3-15

Information technology will be most effective if it is embedded in a curriculum that combines face-to-face interaction of students with peers and instructors along with individual learning and asynchronous communication through networked computers. With such a hybrid model, the bright line that distinguishes between face-to-face learning and distance learning vanishes.

Richard McCray,
University of Colorado, October 2002.[a]

[a]Academy of Sciences of Iran, Proceedings of a Workshop on Higher Education. Tehran, 2004, p. 56.

of Technology. There are over 70 state universities, and this university is generally considered the nation's leading research university in science and technology. The medical universities have a separate system, which includes more than 40 universities where most of the country's medical research is concentrated .

The presentations emphasized research with the Iranian presentations focusing on activities at Sharif University of Technology. An important Iranian presentation addressed transportation research, which was under the purview of a team of senior researchers, most of whom had received their advanced degrees in the United States. The American presentations addressed seismic, plant biotechnology, and cyber research challenges. The sessions concluded with a discussion of opportunities for cooperation and then with visits to the physics and earthquake engineering facilities in order to witness research in action.

WORKSHOPS AS AN INTRODUCTION AND CATALYST FOR FUTURE COOPERATION

A major purpose of the workshops was to provide opportunities for U.S. scientists to become familiar with achievements and capabilities in Iran. This goal was usually achieved—to a limited degree. The hope was that the introductions would lead to further cooperation between interested individuals. However, this objective remains elusive as discussed in Chapter 5.

It was important for the Iranian participants to meet colleagues from the United States. The Iranians had both an advantage and a handicap in connecting with the Americans. Most of the Iranians had well established communication linkages to the U.S. scientific community through family, friends, or professional acquaintances. They knew the international scientific literature, and they spoke English. Since usually the workshops were not their first encounters with Americans, they probably knew what to expect. However, they seemed at times apprehensive as to whether they should enter into new informal professional relationships with Americans without prior approval by the Iranian government.

Over the years, the National Academies have repeatedly been asked why they have spent so much effort preparing Proceedings from the workshops and encouraging other sponsors of the workshops to follow suit. The experience of the National Academies has validated the importance of Proceedings. Requiring papers helps convince skeptics of the program that the workshops are much more than scientific tourism. Also, this requirement

encourages participants to prepare serious presentations for the workshops. Some Iranians greatly appreciate the opportunity to have their papers published in an English-language document, and many other Iranians who did not participate have been interested in receiving the papers that related to their own work. Finally, the publications reach important audiences at both the policy and scientific levels. In summary, the workshops have involved hundreds of scientists and have contributed to both scientific and bridge-building objectives. They have been difficult to arrange, but the effort has provided many channels of communication.

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4

Exchanges, Planning Meetings, and Special Events

The workshop program described in Chapter 3 dominated the cooperative activities sponsored by the National Academies throughout the first decade of engagement. A heavy emphasis on workshops had been planned for the first few years—a period of becoming acquainted. The concept was as follows: After the introductions provided by the workshops, some of the individual scientists from both sides would then follow up their new contacts with colleagues who had similar interests and would continue engagement activities on their own.

But this pattern did not develop. It simply became too complicated for individual scientists to navigate on their own through the political, legal, and financial obstacles to cooperation that have characterized U.S.-Iranian relations. Even the initial workshops took 12-18 months to organize despite strong efforts of the academies in the two countries to show results of the program at an early stage. Also, few funding organizations were prepared to invest in risky collaborations that might never be realized.

It was anticipated that a broadly based program of workshops, exchanges, and other activities—bearing the imprimaturs of the academies in the two countries—would unfold. However, such a program that balanced different themes, different participating institutions, and different age groups of participants, as well as the use of different exchange mechanisms, did not occur. The difficulties in arranging events were greater than anticipated. Trying to conform to a pre-conceived plan for different approaches was simply not possible although the academies often referred to the priority themes

agreed to in 2000 when different cooperative activities were considered. Further complicating the character of the program was an early decision by the National Academies to engage with a number of organizations in Iran in addition to the academies, since the academies were still relatively young organizations.

The National Academies decided to promote activities on an *ad hoc* basis as opportunities appeared, without relying on a well developed implementation plan. Was an appropriate Iranian organization interested in moving forward with an activity? Was an appropriate American scientist prepared to co-chair the activity? Would there be a licensing issue? Were related activities scheduled in the Middle East that would reduce international travel for specialists interested in participating in such activities as well as traveling to Iran?

Of course, the National Academies maintained the position that the topic of any activity would have to be of interest to U.S. scientists if they were to participate with enthusiasm. The policy of science first and political bridge-building benefits second was the mantra. As discussed in Chapter 5, this approach seemed to pay off.

All the while, there were frequent adjustments of plans up to the very dates of scheduled events. Welcome news came in small parcels such as: The last visa approval notification has just arrived, and we can leave on schedule. The visitors have finally cleared customs in New York, and they will make their connecting flight. Permission has been given in Washington for the visitors to meet with U.S. government scientists.

Thus, flexibility was essential to guide the program throughout the decade.

INDIVIDUAL EXCHANGES

The National Academies originally planned for individual exchanges to become a major component of the program. But most American scientists were not eager to travel to Iran alone. Usually, travelers would go to Iran in groups of two or more. Also, they realized that there were few, if any, funding sources for travel to Iran or follow-on activities, thereby dampening enthusiasm for developing unsustainable partnerships.

Many travelers preferred to participate in workshops organized by the National Academies and then add side visits to the proposed workshop itineraries. This approach was followed in most cases. Individual visits by Americans not linked to workshops became the exception rather than the rule.

Meanwhile, Iranian scientists seemed more comfortable coming to the United States to visit relatives or friends rather than to explore new scientific challenges. Efforts were made to combine the two purposes of their travel. This approach was usually successful.

Nevertheless, there were a few individual exchanges in each direction not linked to workshops, conferences, or family visits. About a dozen Americans traveled to Iran, and a comparable number of Iranians visited the United States. In some cases, the activities supported by the National Academies were add-on activities to visits already planned by the travelers and financially supported in part or entirely by other organizations. But in a few cases, the visitors to Iran were traveling only under the auspices of the National Academies; and the visitors to the United States were traveling in response to invitations and visa support provided by the National Academies.

The topics for the visits varied. In the medical area they included cancer research and drug addiction. In basic science, they focused on physics. Several visitors were interested in science policy—a relatively new discipline in Iran. The theme of science and ethics attracted some visitors while others were interested in science and religion. Several travelers to Iran in geosciences received particularly warm receptions. All visitors in both directions had a latent interest in international relations, and particularly in the U.S.-Iran political relationship as it affected scientific cooperation.

The National Academies received positive reports from almost all of the participants in individual exchanges. The participants thought the experiences were useful. They considered the contacts that had been established, were important. They sometimes added that the official views in Tehran on their visits were believed to be positive. Still, the National Academies seldom received reports of follow-on visits.

PLANNING MEETINGS

After the initial four workshops in 2002, the leaders of the academies in the two countries decided that a review of these interactions together with discussions of future directions would be desirable. Leading scientists selected by the academies met in France in June 2003 to focus on future directions, recognizing the importance of flexibility in adjusting priorities as the program evolved. The academies selected three broad topics as the focus of this early planning effort—food security/food safety, energy, and education and values. These themes were on the agendas of many organizations throughout the world as well. An informal report of the meeting was well

received by scientific leaders in Tehran and Washington and in time led to workshops and other activities in each of the three areas.[1]

A less extensive inter-academy review of the engagement program was held in Washington, D.C., in June 2005 on the occasion of the visit to Washington on other business by the President of the Iranian Academy of Sciences. Past activities were discussed, and new topics for cooperation were put on the table as areas of particular interest to the two academies. The importance of cooperation in basic science—physics, chemistry, and biology—was stressed. However, these topics were subsequently perceived by some government officials in the two countries as too closely related to national security interests to pursue. During an inter-academy meeting, the president of the National Academy of Engineering was awarded a medal by the Iranian Academy of Sciences for his contributions to enhancing U.S.-Iranian cooperation in science and technology.

In November 2007, senior leaders of the National Academy of Engineering and the National Academy of Sciences went to Iran to engage in more detailed discussions with colleagues concerning future directions for engagement. The visit included participation of the visitors in two workshops described in Chapter 3 (*Science as a Gateway to Understanding* and *Research at Higher Education Institutions*). The visitors also met with senior officials of the Iranian Government, leading clerics of Iran, and the scientific leadership of the country. Nobel Laureate Joseph Taylor (physics, Princeton University) was included in the group and received the tumultuous reception described below. Another highlight of the visit was a dinner hosted by the Iranian Vice President for Science that included about 50 senior government officials with responsibilities in the field of science and technology and other leading scientists of the country. Appendix C includes the press release on the purpose and results of the visit by the group.

The final planning consultations of the decade were held in Tehran in December 2008 when the president of the Institute of Medicine discussed common interests in medicine with leading medical scientists of the country. As indicated in Appendix D, there was no shortage of topics of mutual interest that seemed well suited as focal points for future interactions. The visit included discussions of recent advances in the medical sciences held at the Academy of Medical Sciences, Shaheed Beheshti Medical University, and Tehran University of Medical Sciences. At the Institute of Tuberculosis and Lung Diseases, the visitors participated in a detailed discussion, supplemented with careful examination of a relevant x-ray, of the basis for a decision as to whether or not to perform a dangerous operation. There

was complete agreement among the visitors and the Iranian surgeons on an appropriate course of action.

In addition to overview discussions of opportunities and results of initial cooperative activities as described above, a continuing dialogue on the importance of cooperation in earthquake science and engineering was carried out by specialists from the two countries for almost the entire decade. Visits by American scientists to Iran and by Iranians to the United States, as well as meetings on the fringes of international conferences in other countries, provided opportunities to discuss common seismic interests. They reviewed experiences following the Bam earthquake, needed measures to prepare for a serious earthquake in Tehran, and the possibility of bringing together earthquake specialists representing the city of Tehran with counterparts in San Francisco and Los Angeles. These discussions led directly to the two workshops on seismic issues discussed in Chapter 3.

VISITS TO IRAN BY NOBEL LAUREATES

As noted in Chapter 1, Nobel Laureate F. Sherwood Rowland participated in the first visit of a delegation of the National Academies to Iran in 2000. He received a highly publicized welcome. His expertise concerning both ozone depletion and urban air pollution seemed to energize young environmental activists in Tehran. His interactions set a very positive tone for future visits by other leading American scientists.

In November 2007, Joseph Taylor stirred considerable enthusiasm for physics during his brief visit. Greeted by a flurry of posters announcing his arrival, he delivered a lecture on pulsars at Sharif University of Technology that was received by hundreds of faculty members and students jammed into an auditorium, hallways, and overflow rooms. The lecture was also transmitted via the Internet to other Iranian universities where physicists and their students had gathered. During the visit, Taylor was "measured" for sculpting of a bust, which now adorns the garden at Pardis Techno-Park of the university.

Two months later, Nobel Laureate Thomas Schelling (economics, University of Maryland) traveled to Iran at the invitation of Sharif University of Technology where he also presented a lecture. In addition, he received an honorary doctoral degree. His visit was widely reported in the Tehran newspapers. He traveled to Shiraz where he was warmly received by one of the leading religious figures of Iran, Grand Ayatollah Haeiri. Schelling pointed out the close connection of the University of Maryland with many

prominent Iranians, and he was strongly encouraged by his hosts to return to Iran. While his visit was not organized by the National Academies, the National Academies took an active interest in endorsing the visit by a member of the National Academy of Sciences.

In April 2008, a fourth Nobel Laureate, Burton Richter (physics, Stanford University) visited Iran. His focus on energy issues during his well-attended lecture and in subsequent discussions provided insights into developments and policies in Iran and elsewhere. The workshop on energy issues arranged during his visit is noted in Chapter 3. He also met with Grand Ayatollah Haeiri who repeated the views previously voiced by the Vice President of Iran for Science on the importance of directing science toward peace throughout the world and avoiding the misuse of science for destructive purposes.

VISIT OF PRESIDENT KHATAMI TO THE NATIONAL ACADEMIES

In June 2006, advisors to former Iranian President Mohammad Khatami suggested that the National Academies arrange a meeting with him during his visit to the United States. The National Academies thereupon invited him to dinner with a small group of leading American scientists and political analysts. He was accompanied by several Iranian foreign policy experts. He was in the midst of a whirlwind tour of the United States, which was leading up to consultations at U.N. headquarters where he was chairing an effort devoted to dialogues among civilizations.

In a wide-ranging discussion, President Khatami was enthusiastic about increasing exchanges of scientists between Iran and the United States. He emphasized the importance of including religious and cultural figures as well. On another topic, he was upset by the refusal of the United States to sell to Iran spare parts for its airplanes purchased in the United States many years earlier and by the canceling of the French commitment to sell 12 airbuses to Iran. Iranian aircraft were carrying passengers throughout the country on planes that were not in good condition. Finally, he noted that while he wanted to have his U.N.-endorsed Center on Dialogues among Civilizations in Iran or the United States, he planned to begin with a center in Geneva.

At the conclusion of the dinner, President Khatami supported the continuation of workshops on cooperation between the United States and Iran. He subsequently participated in the international workshop entitled Science as a Gateway to Understanding, which is discussed in Chapter 3.

PILOT PROJECT ON FOOD-BORNE DISEASES

The most ambitious project undertaken pursuant to the engagement program of the National Academies was directed to improved surveillance for detection of and response to food-borne diseases. This project was planned and carried out by the Research Center for Gastroenterology and Liver Disease of Shaheed Beheshti Medical University, with the participation of an American expert from the Oregon Department of Human Services, in 2005-2007. The activity was focused on a pilot area northeast of Tehran with a population of 340,000 inhabitants. The project had four objectives:

- estimate the incidence of diarrhea in pilot sites,
- determine the etiology of reported diarrhea in pilot sites,
- detect and investigate food-borne and other common-source outbreaks in pilot sites, and
- assess trends over time.[2]

Stool specimens were tested for four categories of E. coli, Salmonella, Shigella, Yersinia enterocolitica, Vibrio cholorae, and rotavirus. After lengthy preparations, during a three-month period 133 cases of diarrhea were reported with nearly one-half involving children less than five years of age. None of the cases required hospitalization or resulted in deaths. Medical treatments varied, with 60 percent of patients using antibiotics, 50 percent using oral rehydration solution, 36 percent using anti-diarrhea/cholinergic medicine, and a few using herbal medicine or self-prepared medicine.[3]

Limitations on the monitoring and reporting system included the following:

- underreporting,
- incomplete cooperation by patients and by night-shifts of staff members who were not well supervised,
- slow transportation of stool samples,
- incomplete pathogen identification due to incomplete knowledge or technical problems, and
- lack of precise epidemiological investigations during outbreaks.[4]

The major strength of the pilot project was that it was a systems project addressed to upgrading both field and laboratory capacities. Given the standardized organizational approach throughout the country, it provided

pointers for improving the food-borne disease surveillance system in different regions of the country.[5] The effort was welcomed by the food and health authorities in Tehran and attracted the attention of institutions in Tehran and other cities. It encouraged development of policies and guidance documents at the national level. The World Health Organization representative in Tehran was very interested in the project and repeatedly commended the Iranians for undertaking the effort.

There was initial reluctance among the health care workers to change their ways in addressing food-borne disease problems. However, after training and witnessing demonstrations of initial activities, they embraced the concept of improving their approach. Appendix B sets forth a dialogue between the key American and Iranian specialists which provides insights as to how this project became a truly interactive effort among specialists from the two countries.

ENCOURAGING INVOLVEMENT OF OTHER U.S. INSTITUTIONS IN ENGAGEMENT ACTIVITIES

As previously noted, an important objective of the National Academies has been to encourage other U.S. organizations to pick up the mantle and become involved in engagement activities. This effort is still a work in progress. Successes to date have been few. Two examples of this effort to diffuse interest and responsibilities in the United States are described below.

Following the visit to Iran by Nobel Laureate Joseph Taylor in 2007, the Ministry of Science, Research, and Technology, after consultations with a number of Iranian university rectors, decided that linkages between Iranian and U.S. universities should be expanded. To this end, the Ministry contacted the National Academies with a proposal to invite several presidents of leading American universities to Iran. The National Academies turned for advice to the Association of American Universities (AAU), which is the focal point for regularly bringing together presidents of about 60 leading research universities of the United States and Canada to address common problems and opportunities for enhancing higher education.

The National Academies and the AAU decided that the AAU would be the most appropriate sponsor of the proposed visit of university presidents to Iran. The AAU arranged such a visit for November 2008. Six university presidents traveled to Iran where they were warmly received by an enthusiastic leadership of the higher education establishment in Iran, by professors and

students, and by the Iranian press.[6] Plans are still being developed to invite a number of Iranian university presidents to the United States in the future.

A second initiative was also launched in 2008 when scientific exchanges were approaching a low ebb. The National Academies and several other U.S. organizations that have interests in expanding exchanges and in encouraging the U.S. Government to assist in this regard decided to have periodic meetings to discuss relevant developments. At the suggestion of the National Academies, the American Association for the Advancement of Sciences (AAAS) became a focal point for organizing large and small meetings with representatives of other NGOs and interested government officials to discuss the way forward. These meetings have been very useful in informing interested organizations of developments that are relevant to their interests while providing a forum for discussing recommendations with the Department of State on future steps.

END NOTES

1. Glenn E. Schweitzer, *U.S.-Iranian Cooperation in Addressing Global Issues*, The National Academies, August 20, 2003, unpublished report.
2. Institute of Medicine, *Foodborne Disease and Public Health, Summary of an Iranian-American Workshop,* National Academies Press, 2008, p. 11-14.
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6. IRNA, "Science Minister, American Deans Confer," *Iran News*, November 17, 2008, p. 2.

5

Impacts and Future Directions

For decades, the universality of sound scientific principles has been recognized throughout the world. In situations where the communications between scientists from two countries are abnormally few or difficult, such as has been the case in U.S.-Iran relations during the past decade, special efforts to build scientific linkages can be important. Scientific benefits of sharing experiences among specialists who are working in similar fields but in different geographic and cultural environments—such as the different environments of the United States and Iran—have often been apparent to the participating scientists, immediately or after short periods of time. For example, international cooperation has sensitized scientists to the strengths and weaknesses of capabilities and approaches of foreign counterparts in addressing problems of mutual interest (e.g., stem cell research in the United States and Iran). They sometimes see on-the-ground activities that are ahead of, but relevant to, efforts in their own countries (e.g., advanced techniques for breeding of sturgeon and other species in hatcheries in Iran). The scientists can then better evaluate the significance of the scientific findings that are set forth in publications of their counterparts.

Other types of benefits of cross-border interchanges can also be important. Understanding the similarities and differences in related approaches used by scientists who are thousands of miles apart can at times be helpful (e.g., dangerous surgical procedures that threaten the cardiovascular systems of TB patients in Tehran and Houston). Collaboration has sometimes documented how findings in one physical environment help explain the

scientific aspects of similar problems encountered in other settings (e.g., pollution impacts on biodiversity in the Caspian Sea and in lakes of North America). Joint efforts have frequently clarified the magnitude and importance of problems that should be of international concern but are not receiving adequate preventive attention in national programs (e.g., dust storms reaching central Tehran due to sand uptake far to the west of the capital). At times, visiting scientists witness phenomena that are inconsistent with global trends (e.g., frequency of certain forms of stomach cancer in Iran), see developments that will soon become global trends (e.g., increasing obesity in the United States), and hear warnings of looming global disasters (e.g., impacts of climate change in both countries).

The thousands of Iranian-American scientists who have emigrated to the United States in recent decades and have then successfully pursued scientific careers provide strong testimony to the increasing internationalization of (a) scientific knowledge and (b) scientific approaches that lead to new discoveries and new applications of science. Such migrations of scientists have repeatedly demonstrated that a sound basis for scientific inquiry can transcend geographical and political boundaries. To participate effectively in modern science, researchers simply cannot ignore achievements of colleagues in distant lands.

Many scientists in the United States and Iran routinely rely on a global outreach while at times recognizing the limitations on their contributions to science that result from current constraints on U.S.-Iran cooperation. But many other Iranian scientists are not accustomed to searching through the findings of foreign colleagues for solutions to common problems. Thus, it is not surprising that Iran has both (a) scientific strengths, which take into account experiences elsewhere (e.g., treatment of drug addiction), and (b) weaknesses in research areas, which are well developed in other countries (e.g., ecological modeling of watersheds). Thus, the world can benefit from some of Iran's strengths (e.g., Iran's contribution to the earthquake response effort in Pakistan side-by-side with the U.S. response effort), and Iran can begin to catch up in other areas by following the lead of more advanced colleagues from abroad (e.g., mastering techniques for liver transplants). There are some areas wherein all can learn together (e.g., personalized medicine).

Few aspects of international cooperation can be kept under wraps in laboratories or at field investigation sites. Scientists, journalists, and historians throughout the world prepare frequent commentaries for the public on the value and details of international scientific cooperation. They regularly

write about (a) scientific revelations uncovered by international teams that are spreading across the continents and (b) benefits of international collaboration in building trust and understanding among colleagues from different nations. They often focus on the importance of new channels of communication, and particularly the Internet, in increasing contacts with researchers from countries who have been isolated from the mainstream of international science. Indeed, seldom does a week go by that *Science, Nature,* and other journals do not have reports on the payoffs from international cooperation, often focusing on countries that have been estranged from the international community. At the same time, a growing percentage (more than 20 percent) of the articles in internationally recognized journals are co-authored by scientists from two or more countries.[1]

International success stories based on science frequently are linked to sustained cooperation among institutions in different countries over many months or years. The U.S.-Iran engagement program of the National Academies has been devoted primarily to only short-term interactions; and attribution of scientific breakthroughs to such brief encounters is unrealistic. Nevertheless, given the reach of the engagement program in terms of the number of participants and topics, modest scientific impacts of the program are beginning to emerge; and some impacts may be of considerable international interest in the future.

Against the widespread conviction that in time international cooperation often pays off for the scientists who have been involved and at times for a broader segment of society, this chapter summarizes some of the outcomes to date of the U.S.-Iran scientist-to-scientist engagement program of the National Academies. It also addresses potential political benefits from scientific cooperation. The program has been one of the most active U.S. scientist-to-scientist programs with Iran in recent years although given the capabilities of the scientific community in Iran, it has been very modest in size. According to U.S. government officials, the political impacts of even limited engagement efforts are important in helping to gradually restore a more positive U.S-Iranian relationship and in beginning to set the stage for broader people-to-people programs.

FOLLOW-ON ACTIVITIES TO INITIAL ENGAGEMENT EVENTS

Previous reports of the National Academies have presented survey-based evaluations of follow-on activities related to much larger exchange programs in other regions of the world. Shortly after completing their initial

cooperative activities, the participants were systematically asked to provide comments on follow-on activities. They were also asked for suggestions for improving the programs.[2]

However, the limited resources available for carrying out a small program with Iran have been focused entirely on ensuring that operational activities would be adequately supported. Also, uncertainties about the political implications of distributing questionnaires concerning impacts discouraged such a practice. This report is the first attempt to collate a few examples of follow-on activities. While the follow-on activities that are cited throughout this report are far from a complete list, they nevertheless are helpful in assessing the impacts of the program.

Clearly, obstacles of all types prevented full realization of many aspects of the planned efforts. But the results have to be judged within a broad context. This context, previously discussed in Chapter 1, has included (a) increasingly hostile relations between the U.S. and Iranian governments, (b) elections in both countries that introduced new administrations and new policies, (c) uncertainties concerning developments within Iran in the wake of the election in 2009, and (d) continuing calls in Washington for more stringent economic sanctions, which may have a spillover effect in constraining scientific cooperation.

Chapters 3 and 4 have identified a number of the near-term follow-on activities that have resulted from specific workshops and other cooperative events. Follow-on activities involving continued cooperation among some of the original participants have been noted (e.g., additional workshops on related topics). Also, follow-on activities that have been undertaken without the benefit of further cooperation opportunities have come to light (e.g., Iranian purchases of new experimental equipment for microbiology investigations of food contaminants).

Almost all cooperative follow-on activities have depended on continuation of organizational and financial support for the activities by the National Academies and its philanthropic partners, as well as by the ability of Iranian counterpart organizations to organize and finance their share of appropriate follow-on arrangements. Few spin-off cooperative programs that are organized and financed through other channels have developed, even though this type of spin-off sustainability of cooperation has been an objective of the National Academies from the outset of the program. While such continuation of joint efforts has been a frequent discussion topic, particularly at universities in Tehran and at other venues where workshops have been held, little follow-on activity has been initiated by

the participants themselves without the direct involvement of the National Academies.

As noted in previous chapters, seldom have the individual American participants in engagement projects had the time, financial resources, and inclination to try to organize follow-on cooperative activities on their own. Also, Iranian colleagues seem to have been reluctant in taking the initiative. They have often stated, "We will be in touch by e-mail." But the e-mails may not arrive.

Support on the U.S. side by the National Academies, universities, or other organizations with capabilities to mount and sustain international programs seems essential if U.S.-Iran science cooperation is to expand, or even to continue. The one exception—and it is an important exception—is the attendance by scientists who have been participants in academy-sponsored activities in subsequent international scientific conferences, which are held in the two countries. The National Academies have received several positive reports of such participation following events on the same or similar topics sponsored by the National Academies (e.g., cancer conferences in the United States and environmental engineering conferences in Iran).

Beginning in the early 1990s, a number of U.S. universities effectively sustained active science cooperation with Iranian universities for a few years with no involvement of the National Academies. Such sustained relationships seemed to have increased the commitments of individual scientists to working with colleagues across the ocean. Usually Iranian exchange students were an important component of the cooperation. But as Iranian science students in the United States decreased in number, due in large measure to problems in obtaining U.S. student visas for studies in technical areas, interest of some U.S. universities in science engagement also decreased. U.S. universities could not count on Iranian tuition payments as one of the incentives to maintain science cooperation, as had been the case at some universities a few years ago. Also, the decline in exchange students has increased the difficulty in justifying outreach to Iran. With declining resources for outreach, some U.S. universities have turned their attention to other less daunting activities.

However, even one-time interactions of Iranian and American scientists such as those sponsored by the National Academies can influence their views and subsequent actions. They frequently receive strong impressions as to the importance or the limitations of their own scientific research agendas, the need to use information from colleagues around the globe, and the quality of activities behind scientific articles prepared by counterparts. Walking

through a U.S. laboratory with modern research equipment has been an eye-opening experience for some Iranian visitors who work in facilities with older and more modest equipment. And advanced laboratories in Iran have also surprised American visitors.

Most American participants in the engagement program had their first encounters with Iranian counterparts through participation in the program. With a few exceptions, the Americans have been enthusiastic about the interactions. Many have stated that they would welcome additional opportunities for such contacts in order to delve deeper into scientific accomplishments in Tehran and other scientific hubs of Iran.

Also, Iranian attitudes toward the possibility of follow-on interactions have been positive. The repeat-participants in activities sponsored by the National Academies presumably considered their initial experiences worthwhile. In addition, the Iranian workshop participants, as well as the American participants, have almost always completed their papers for publication in Proceedings and other reports.

SCIENTIFIC PUBLICATIONS

Discussions of the importance of scientific publications have frequently taken place during U.S.-Iran workshops and associated visits to facilities. Also, preparation of Proceedings of workshops that have been published by the National Academies and its partners has required that the submitted papers meet an acceptable quality level. Some papers prepared by Americans and by Iranians have been rejected. Others have been revised one or more times before they were accepted. Unfortunately, the National Academies were obliged to withdraw one Iranian paper from the electronic version of a Proceedings after the Proceedings had been released and posted on the academies' website when it was discovered that some of the text had been copied from a related article without references.[3] Clearly, the workshop participants have become aware that publication of a paper requires a review process that is not to be taken lightly.

Many Iranian scientists, including some who occupy or have occupied important government positions, have long been aware of the importance of the integrity of the process that leads to scientific publications. They know the requirements for publishing in journals that are covered in the Web of Science Citation Index maintained by the Institute of Science Information (ISI), herein referred to as ISI journals; and success in publishing in these journals is a highly valued achievement. However, other Iranian scientists

have not ventured into this arena, confining their publications to Iranian journals, and particularly Farsi-language journals, which may not meet international standards.

Leaders of the Iranian scientific community will probably continue to advocate compliance with internationally acceptable publication standards, even for Iranian journals published in Farsi. They still have a long road ahead. However, they know that international credibility rests squarely on the credibility of Iranian publications. U.S. encouragement of adherence to good publication standards is desirable; and such encouragement has been possible during the engagement program.

During the workshops and other engagement events, various publications are sometimes distributed. The U.S. publications are always quickly taken by Iranian counterparts. Other U.S. publications that are cited during the course of the interactions are frequently requested by Iranian participants and if available, they are provided electronically. Important international publications that are not available electronically are clearly in short supply in Iran.

In 2009, the journal of Sharif University of Technology, entitled *Scientia Iranica*, received international recognition as an ISI journal due to the combined efforts of Iranian and American participants in the engagement program. The accreditation process was not simple. The editor of the Iranian journal had difficulty responding to the application requirements without the help of an American counterpart who in turn was in contact with a representative of the ISI. The newly recognized journal must now operate under international ground rules that should help ensure its integrity as a reliable publication. Twenty-eight Iranian journals, primarily in biomedical and engineering fields, are ISI journals;[4] but *Scientia Iranica* is unique in its broad swathe of science and engineering disciplines and topics.

As to Iranian-authored articles published in ISI journals, the number of articles has steadily increased in recent years, growing from 1,500 in 2000 to 5,500 in 2005 and was still increasing at that time. The Iranian publications far exceeded publications from other Middle Eastern countries except Turkey and Egypt, although in 2005 the Iranian number passed the number of Egyptian publications. The number of Iranian articles co-authored with foreign colleagues was about 1,100 in 2005, with Americans being the largest number of co-authors. While this number is small, in time some of the interactions under the program of the National Academies and other scientist-to-scientist programs may lead to additional articles with co-authors.[5]

INTERNATIONAL VISITOR PROGRAMS

The National Academies have participated in three International Visitor Programs (IVPs) that have been sponsored by the Department of State. They addressed food-borne diseases, water conservation, and earthquake science and engineering. They involved a total of 45 Iranian specialists. IVPs bring to the United States professionals from Iran, as well as many other countries, as noted in Chapter 3. The length of stay for Iranians under this program is usually about three weeks. The roles of the National Academies have been (a) ascertaining interest of reliable partners in Iran for assuming responsibility within Iran for each of the programs, (b) organizing and hosting a scientific workshop during the visit, involving 25-40 participants, and (c) providing assistance to the Department of State in arranging associated visits by the Iranian visitors to scientific and other facilities in the United States.

At the conclusion of each three-week session, representatives of the Department of State meet with the Iranian visitors to listen to comments on their visits and suggestions for future exchanges. Observations provided by the Department concerning the overall Iran program, which has involved more than 250 Iranian visitors to the United States since 2006, are as follows:

> *The program began the process of re-establishing contacts between academic, professional, and cultural communities in the two countries and helped reconnect Iran to the United States. The first-hand experience of observing American society and its people has . . . generated goodwill and respect. . . . Many Iranians have stated that their impressions of Americans and their culture have improved dramatically. Most, if not all, participants have expressed the hope of remaining in contact with Americans they met during the program and of having some Americans visit them.*[6]

ADMIRATION OF IRANIANS FOR SCIENCE IN THE UNITED STATES

Reports of western-initiated public opinion polls in Iran have repeatedly shown that U.S. science and technology are highly respected by Iranians, a finding that is consistent across the neighboring countries as well. Also, U.S. universities receive favorable ratings as respected institutions.[7] These positive attitudes toward American science and education are undoubtedly

rooted to some extent in oral and written reports disseminated throughout Iran by Iranian visitors to the United States over many decades. Awareness of U.S. technological accomplishments is also enhanced by media portrayals of economic achievements based on science and technology in the United States and by continuing reports of life in the United States by the Iranian diaspora. Short-term visits to the United States have provided opportunities for a few Iranians to "ground truth" such reports.

Scientist-to-scientist programs that provide opportunities for Iranians to have direct contact with contributors to science and education achievements are probably adding to the perpetuation of such positive images. It is not possible to attribute a specific workshop, exchange visit, or other type of collaborative project to a general enhancement of the image of the United States. But the cumulative effects of such interactions are most likely a contributory factor to the positive images of U.S. science and universities that are prevalent in Iran.

Chapter 4 describes the visits of U.S. Nobel Laureates to Iran and the enthusiastic receptions they received. In recent years, American scientists have dominated the lists of recipients of Nobel Prizes. Consequently, many Iranians are convinced that much of the best science in the world emanates from the United States. For a Nobel Laureate to take the time to travel to Iran makes a huge impression on scientists, students, and the general public that cannot be measured—only admired.

But visits of less renowned scientists can also have positive impacts on significant audiences, and particularly students in the audiences. Unfortunately, distinguished American scientists are increasingly rare visitors to Iran due to the political turmoil in the country. When they have given presentations to audiences of 100 students or 30 faculty members, for example, the reactions have been punctuated with desires to want to hear more.

MAINTAINING CHANNELS OF COMMUNICATION

One of the strengths of the program of the National Academies has been its continuity over a decade. The National Academies have become well known to a number of institutions in Iran as well as in the United States. Judging from the number of inquiries to the National Academies concerning scientific relations with Iran, they are increasingly recognized as a good source of up-to-date information on the state of scientific interactions and challenges in bringing together colleagues from the two countries.

The National Academies have provided a channel of informal communications between important members of the two societies. There are of course many other channels of communication. When aggregated, these channels seem to have a positive effect on developments within Iran while helping to provide insights of broad international interest.

ENCOURAGING OPENNESS

Most of the foregoing observations relate directly or indirectly to the importance of openness when considering cooperative ventures that might be interesting for American scientists. Authoritative reports about science and technology activities in Iran are in short supply. Such reports are occasionally received by the National Academies, usually in connection with specific events that are being scheduled or have been completed in Iran.

But general awareness of civilian activities in Iran is a long way from international expectations for countries with significant scientific capabilities in fields that are distant from security and proprietary interests. Only limited information about Iran's science and technology achievements is publicly available, and the insights during engagement activities can be helpful to the international community. As such information spreads, it can also help clarify for the international community opportunities for engaging Iran, which must look outward if it is to maximize the effective use of its technological capabilities.

Openness becomes particularly important if the information that is shared relates to developments of broad international importance. Many analysts within and outside government in Washington are focusing on the development of Iran's defense-related capabilities. But few are devoting their efforts to understanding the workings of Iran's civilian infrastructure for science and technology and the international potential of Iranian science, which are the interests of the National Academies,

Examples of questions of interest are the following: What are the characteristics of Iran's capabilities in emerging areas of international importance such as progress in nanotechnology applications? Do documents published in Tehran about Iranian science exaggerate, underestimate, or accurately characterize Iran's technical capabilities to support economic and social development? How can Iran's well-trained workforce use its talents effectively when there are limited job opportunities in high technology areas? How could Iran become a regional leader in areas of science and technology that would be welcomed by neighboring countries and the world?

The answers to such questions should be taken into account as western governments develop strategies for engagement with Iran. The National Academies can contribute to discussions of such issues. But it should be recognized that other U.S. scientific organizations (e.g., American Physical Society, U.S. Geological Survey) may be better equipped to delve into many of the issues in more detail and then to suggest approaches for science engagement.

IMPACTS ON U.S. POLICY FORMULATION

The National Academies frequently consult with the U.S. Government concerning policies and programs directed toward Iran, and particularly the Department of State's people-to-people engagement activities and the Department of Treasury's policy on economic sanctions. The government seems to welcome the views of the National Academies, given the on-the-ground experience in Iran of the National Academies. When asked as to whether the program of the National Academies usefully complements other exchange programs, the answer of U.S. officials has always been the same: "Yes, and we are eager to learn about your experiences."

LESSONS LEARNED

Throughout this report, many suggestions have been offered concerning steps to help ensure that cooperative activities take place and that they are rewarding for the participants and their institutions. Five lessons-learned stand out as guideposts for future activities within a contentious political framework. They are as follows:

(1) Committed and influential U.S. and Iranian leaders of individual projects are essential both to bring important specialists to the table and to navigate successfully through the government policies and procedures that determine whether and how each project can be implemented.

(2) The project leaders should be strongly encouraged to invite young professionals to be among the participants.

(3) When an opportunity for implementation of a project of interest to both sides arises, immediate steps should be taken to carry out the project even if it is not at the top of the priority list of projects-in-waiting.

(4) Documentation of the results of projects that are publicly available can significantly magnify the impact of projects.

(5) An important criterion in selection of project participants should be the likelihood that they would have the interest and time to sustain the contacts made during the projects.

FUTURE DIRECTION OF THE PROGRAM OF THE NATIONAL ACADEMIES

At the level of individual scientists, there are conflicting voices in both Iran and the United States as to whether scientific exchange programs can be effectively carried out within the constraints imposed by the security policies in the current political environment. Nevertheless, most well-informed scientists in the two countries with whom the National Academies have contacts favor continuation of engagement activities to the extent possible. They recognize that there may be personal risks. The National Academies are prepared to move forward, but ensuring the personal safety of participants overrides all other considerations.

Scientific areas that might be considered for future cooperation have been identified throughout this report. Building on past cooperative activities should be a high priority in developing the next phase of cooperation.

Some forces in Iran would welcome a termination of engagement programs involving the United States, including engagement in science. At the same time, given Iran's long-standing commitment to excellence in science, it is difficult for even these voices in Iran to ignore the wellsprings of technology in the United States. Nor have these isolation-oriented voices succeeded in suppressing the views of others who believe that scientific cooperation is essential if Iran is to graduate from the status of a developing country and join the ranks of the industrialized countries in the foreseeable future.

The Iranian Government has alternatives to dealing with the United States and its political allies in modernizing the country through more effective use of technology. China is selling petrochemical equipment to Iran, and Russia has found Iranian customers for its nuclear and aerospace technologies. But the United States is still at the apex of scientific achievements and university education in the eyes of important Iranian leaders. Every year, many members of Iran's elite of different political persuasions support efforts of their science-oriented children and other relatives to obtain U.S. student visas or green cards.

Against the background of uncertainty as to future Iranian policies, the National Academies have taken several steps to sustain its engagement activities during 2010 and 2011. They have kept on the table a number of areas

for cooperation that have been discussed for several years. They continue to work with the Department of State, which has its own people-to-people agenda. Also, they offer this report to help focus discussions on next steps.

When opportunities arise, consideration should be given to ambitious projects. By all accounts, the pilot project on food-borne diseases was a successful effort that attracted much attention in Iran and in Geneva, the home of the World Health Organization, as well as support in the United States. Another sustained project with operational aspects carried out under the auspices of the National Academies seems desirable.

Among the topics that have been discussed informally in the past with Iranian colleagues as the basis for an ambitious undertaking are the following: (a) collaboration on assessments of the challenges in restoring the shrinking marshes on both sides of the Iran-Iraq border near the Persian Gulf, with a focus on water recycling and holistic engineering approaches, (b) designation of an international network of centers of excellence for improving seismic resilience of structures through enhanced construction designs and practices in Tehran and other major cities from Turkey to Pakistan, (c) upgrading one or more Iranian national parks to international status for preservation of biodiversity, and particularly unique plant and animal species of the region, and (d) creation in Iran of a regional center for research and training in radiation therapy and patient safety to reduce medical errors throughout the region. Other topics are suggested in this manuscript, particularly in the appendices. From archeology and astronomy to zoonotic diseases and zoology, the topics of common interest are numerous and diverse.

SCIENCE AS A GATEWAY TO UNDERSTANDING

Iran's size, its geo-strategic location, and its abundant energy resources ensure that the country will be an important player in international affairs for the indefinite future, both regionally and globally. Its talented workforce, particularly in science-related endeavors, should provide a base for moving forward economically. But neither the Iranian Government nor an increasingly outspoken population is in agreement as to Iran's future political direction, either internally or internationally.

The neutrality and prestige of science, which is said by many Iranians to have been in the DNA of the Persians, can steer important segments of the youth toward science careers leading to personal satisfaction and professional recognition. Highly motivated young professionals seem willing to accept excessive government control of their laboratories and to tolerate

unemployment uncertainties. At the same time, science offers rallying points for bringing parties together nationally and internationally without the need for any party to make political compromises.

Cooperative projects can continue to facilitate integration of Iran's scientific aspirations with global realities and with the interests of the United States and other science leaders. Scientific cooperation is one of the few options for bridging differences that separate the two governments. Together, the two scientific communities can begin moving toward important scientific gateways to understanding and international security. Hopefully, the roads through the gateways will be short and will offer rewards for science and for the general populations of the two countries.

END NOTES

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3. Declan Butler, "Plagiarism Scandal Grows in Iran," *Nature*, Vol. 462, December 10, 2009, p. 704.
4. Information on ISI activities provided in March 2010 by james.testa@thomsonreuters.com.
5. Mojtaba Shamsipur, "The Role of Chemistry and Biology in the Future Development of Iran," *Science and Technology and the Future Development of Societies, International Workshop Proceedings*, National Academies Press, 2008, pp. 66-69. Also, Declan Butler, "The Data Gap," *Nature*, Vol. 444, 2 November 2006, pp. 26-27.
6. Department of State, January 2010.
7. For a polling report on the very positive attitudes in Iran and selected Arab countries of U.S. scientific achievements, see *Changing Minds, Winning Peace—A New Direction for U.S. Public Diplomacy in the Arab and Muslim World*, Report of the Advisory Group on Public Diplomacy for the Arab and Muslim World, Committee on Appropriations, U.S. House of Representatives, 1 October 2003.

APPENDIXES

Appendix A

Conclusions of the Meeting of Academy Leaders (2000)

Conclusions of the Meeting between the Academy of Sciences and the Academy of Medical Sciences of the Islamic Republic of Iran and the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine of the United States of America.

The Academy of Sciences and the Academy of Medical Sciences of the Islamic Republic of Iran and the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine of the United States of America agree to hold up to six workshops over the next two years on topics of important interest of the Academies. The workshop topics will be determined by mutual agreement of the Academies and will focus on the situations in Iran and the United States. Possible areas for these workshops include:

1. Protection of ecology and resources of the Caspian Sea and Persian Gulf;
2. Life-long education in science and engineering, including K-12, teacher training, university education, continuing education, open-learning, and distance education;
3. Epidemiology of smoking and drug addiction and their consequences;
4. Measurement and control of air, water, and soil pollution in mega-cities with a focus on Tehran;

5. Science and ethics: (a) ethics in the use of scientific knowledge, and (b) science and ethics in democratic societies;
6. Conservation of resources and manpower: attitudes, policies, and technological opportunities;
7. Conservation and recycling of water and methods for enhancing water supplies;
8. Future energy supply and demand options in Iran and their associated environmental and health impacts, including special consideration of solar and other renewable resources;
9. Lessons learned from recent earthquakes and advances in earthquake engineering applicable to existing and new buildings in Iran;
10. Developing the base for scientific and technological advances in Iran with special attention to alleviating the negative consequences of brain drain;
11. Steps to help ensure food security in Iran;
12. Transportation policy with emphasis on accident treatment and reduction; and
13. Capabilities of developing countries to utilize available information technologies and know-how.

For these workshops, the Iranian Academies and the American Academies agree to cover the cost of the international travel of their respective representatives and the local costs of the workshops held in their respective countries. The Academies expect that up to three workshops will be held in 2001 and up to three workshops will be held in 2002. Three of the workshops will be held in Iran, and three in the United States. The timing, location, and topic of each workshop will be decided by mutual agreement of the Academies with sufficient time being allowed for preparation and planning of the workshops and for inviting appropriate scientific, engineering, medical, and other experts. It is expected that each workshop will consist of approximately fifteen invited participants.

In addition, the American Academies are willing to cover the cost of the participation of a young Iranian scientist in its summer intern program on science policy in 2001 and another young Iranian scientist in its summer intern program in 2002. Opportunities for young American scientists and engineers to participate in science policy activities in Iran will also be explored.

The Academies will also work to overcome obstacles and enhance opportunities for exchange of scientists, scholars, and students between the United States and Iran.

Signed by the following on 28 Shalrivu 1379, September 18, 2000:

Dr. Reza Davari Ardakani
President
Academy of Sciences of the Islamic Republic of Iran

Dr. Iradj Fazel
President
Academy of Medical Sciences of the Islamic Republic of Iran

Dr. Bruce Alberts
President
National Academy of Sciences of the United States of America

Dr. William A. Wulf
President
National Academy of Engineering of the United States of America

Dr. David Challoner
Foreign Secretary
Institute of Medicine of the United States of America

Appendix B

Dialogue of U.S. and Iranian Experts on Food-borne Diseases (2006)

Example of Genuine Collaboration
(Comments of U.S. expert indicated in italics)

- *Is the system to be operated by national authorities, the local or provincial authorities, the academic sector, or some combination of them? Will it be based on legally mandated reporting, will it be voluntary, or will it be a hybrid? Which organizations will be the reporting entities? How will issues of patient confidentiality be addressed?*

We would suggest that the surveillance system will be discussed, established, and operated by all stakeholders, i.e., a combination of national authorities, the local authorities, academic sector, and nongovernmental organizations (and perhaps the industries). We would also suggest that disease surveillance systems rely on mandatory reporting of cases by physicians and laboratories. Most diseases will be reported to the local health department from where they are reported to the national surveillance institute.

We believe that the protection of patient privacy (recognition of a person's right not to share information about himself or herself), data confidentiality (assurance of authorized data sharing), and system security (assurance of authorized system access) are essential to maintaining the credibility of the surveillance system in Iran. This protection must ensure that data in a surveillance system regarding a person's health status are shared only with authorized persons. Physical, administrative, operational, and

computer safeguards for securing the system and protecting its data must allow authorized access while denying access by unauthorized users.

- *Which diseases will be monitored?*

The epidemiological pattern in Iran is undergoing a transition from infectious diseases to chronic diseases. Iran faces an increasing burden of chronic diseases mainly due to changing lifestyle behaviors. Thus, chronic diseases are now the greatest health problems in Iran. Indeed, there is a sense of urgency in the need to enhance the capacity for surveillance of chronic diseases (or non-communicable diseases) in Iran. However we think that a surveillance system can and should monitor communicable and non-communicable diseases, pollution, and road traffic accidents. Road accident is emerging as one of the major killers.

- *To what extent will surveillance for food-borne/enteric diseases be integrated with other, pre-existing surveillance programs in Iran (e.g., those for cholera, TB, malaria, HIV/AIDS)? Is it a matter of "adding a few more diseases to the list" or creating a new, more vertically integrated system?*

We are more interested in an integrated system in order to avoid the duplication of effort and lack of standardization that can arise from independent systems.

- *What laboratory resources will be available, how will isolates be collected and transported, what techniques will be employed to characterize them (e.g., salmonella serotyping, molecular subtyping, antibiotic susceptibility, sequencing), and how quickly will these laboratory data be available to epidemiologists?*

Facilities for microbial culture, characterization, and genotyping by direct automated sequencing or pyro-sequencing, or antibiotic susceptibility testing (by either traditional disc-based methods or newer genotype-based methods and molecular sub-typing) are available.

If the techniques could be used efficiently, results could be available to epidemiologists within a few hours to days.

- *Will the system be sufficiently flexible to eventually encompass a broader set of diseases, such as hepatitis A and B?*

Since a flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds and it can also accommodate, for example, new health-related events (or changes in case definitions or technology), we prefer to have a system flexible to accommodate other health-related events, such as cancer or hepatitis.

- *Will the collection of data be sufficiently timely to permit effective public health action?*

Yes, speed between steps in a public health surveillance system is very important for us for control of health-related events, including immediate control efforts, prevention of continued exposure, and program planning.

- *How will outbreaks be recognized?*

Among all surveillance approaches to early detection, whether through traditional disease reporting, specialized analytic routines for aberration detection, or surveillance using early indicators of disease outbreaks (such as syndromic surveillance), we prefer the last one (due to its ability for detecting outbreaks of diseases earlier and more completely than might otherwise be possible with traditional public health methods).

- *How will recognized outbreaks be investigated?*

There are essential steps in any epidemiological investigation regardless of how the outbreak is detected. With the use of syndromic surveillance, some steps might receive greater emphasis than others. Here are the six basic steps recommended in the United States:

l) confirm existence of outbreak,
2) verify the diagnosis,
3) estimate the number of cases,
4) orient the data to person, place, and time,
5) develop and evaluate hypotheses, and
6) institute control measures and communicate findings.

Appendix C

National Academies Expand Cooperation with Iranian Research and Education Centers (2007)

National Academies Press Release

Following productive discussions in Iran between representatives of the National Academy of Sciences (NAS) and National Academy of Engineering (NAE) and senior Iranian officials and scientific leaders, the U.S. National Academies plan to expand a program of scientific cooperation with Iranian institutions that began in 1999. During the past eight years, continuing political confrontations between the U.S. and Iranian governments have complicated bilateral scientific cooperation, but with perseverance by scientific institutions in both countries, important programs have been carried out.

Wm. A. Wulf, leader of the team that visited Iran from October 13 to 22 this year and the former president of the National Academy of Engineering, said that "we have an historic opportunity to continue our work with Iranian colleagues on problems of global importance that will not only advance international science and engineering, but also build trust and respect for one another throughout our societies."

Sharif University of Technology, in cooperation with the Iranian Academy of Sciences, was the host for meetings and visits in Tehran and several other cities. Iranian participants enthusiastically welcomed plans for expanded cooperation. The discussions uncovered a number of topics of mutual interest and a shared desire to strengthen collaboration. Among the projects to be undertaken are the following:

—Iran's Vice President for Science Sadegh Vaez-Zadeh challenged Iranian and American scientists to help monitor and deter inappropriate "uses of scientific discoveries that cause harm," either inadvertently by inadequate foresight or willfully by violating international norms. In response, a bilateral dialogue will be initiated on general principles to deal with such issues with an initial focus on biological research, applications of nanotechnology, use of fossil fuels, and use of cyber technology.

—During a workshop titled "Science, A Gateway to Understanding" where the American team made presentations, former Iranian President Mohammad Khatami urged the participants to use achievements of science to benefit all nations, increase understanding among people, and avoid destructive confrontations. A follow-on workshop, which will emphasize practical means of moving toward "understanding," will be held in 2008.

—The ninth in the series of bilateral workshops on various topics that began in the year 2000 will focus on reducing earthquake damage. It will be held in Iran in early 2008 on the topic of "adobe and unreinforced masonry structures."

—An exchange of science policy specialists between the National Academies and Sharif University will begin in 2008 with an emphasis on young professionals.

—An effort to establish channels of communication between Thomas Jefferson High School for Science and Technology, Fairfax County Public Schools, with a counterpart secondary school in Tehran will be explored; initial steps to do so were taken during the visit.

A particularly notable aspect of the visit was the contribution of Joseph Taylor, a Nobel Laureate in physics from Princeton University. He delivered a scientific lecture to an enthusiastic audience of more than 1,000 professors and students at Sharif University with Internet connections set up throughout the country. Taylor participated in many television interviews, and he provided personal insights on the life of a scientist to the Iranian students.

The American team also had discussions with representatives of other Iranian institutions in addition to leaders of universities and research centers. One such discussion was a dialogue among scientists, philosophers, and religious scholars in the city of Qom, followed by a meeting with Grand Ayatollah Mousavi Ardebili.

This program of scientific outreach and cooperation by the National Academies has been consistently endorsed since its inception by the U.S. Department of State and by the Office of Foreign Assets Control of the U.S. Department of Treasury. It has also been encouraged by the Iranian government as the American team was told on numerous occasions while in Iran. Financial support has been provided by the National Academies and the Richard Lounsbery Foundation.

October 31, 2007

Appendix D

Suggested Medical Topics for Cooperation (2008)

- Personalized Medicine,
- Evidence-Based Education,
- Cancer Trends: Breast, Colorectal, Lymphatic,
- Burden of GI Diseases in Iran,
- Inflammation as Source of Chronic Diseases,
- Cells as Replacement Therapy,
- Endoscopy,
- Quality and Safety of Clinical Care,
- Design and Interpretation of Clinical Trials,
- Molecular Biology of Microorganisms and Emerging Infectious Diseases,
- Zoonotic Diseases,
- Highway Accidents, and
- Biomedical Ethics.

SOURCE: Based on consultations in Tehran with leading Iranian medical specialists by the president of the Institute of Medicine, December 2008

Appendix E

Statement by U.S. National Academies on Scientific Visits to Iran (2008)

The National Academy of Sciences, National Academy of Engineering, and Institute of Medicine have had eight years of mutually beneficial scientific cooperation with scientists in Iran. These non-governmental exchanges encouraged by both governments have involved participants from over fifty Iranian and American research and academic centers, a dozen workshops in Iran and other locations, a number of planning sessions in Iran, and individual visitors in both directions. The most recent activity was the invited visit of leading American medical scientists to Iran at the beginning of December 2008. During the visit, the scientific leadership of Iran fully supported expansion of scientific exchanges, and a number of topics for further collaboration were jointly identified.

At the end of the visit, however, three persons who identified themselves only as Iranian "security officials" detained one of our scientific staff members who had facilitated the visit and interrogated him for nine hours over three days. During this time, these persons threatened that the staff member would not be allowed to leave Iran and stated that exchange scientists were not welcome in Iran. They exhibited little knowledge of the arrangements that had been made in Iran for this visit and for previous visits. This action was a very serious breach of the understandings by which the U.S. National Academies have sponsored and encouraged scientific exchanges with Iran.

The staff member was traveling on an American passport with a valid Iranian visa issued expressly for participation in the visit. He had made frequent visits to Iran with other groups of American scientists without

difficulties. He is well known at the highest levels of the Iranian scientific community, and over the years political leaders of the country have repeatedly supported his efforts.

The Academies' presidents cannot sponsor or encourage American scientists to visit Iran unless there are clear assurances that the personal safety of visiting scientists will be guaranteed and that they will be treated with dignity and respect. We have attempted to inform appropriate authorities in Iran and to obtain these assurances. While awaiting clear assurances, the Academies are prepared to continue scientific exchanges with Iranian scientists that can be arranged outside Iran due to the scientific importance of such interactions.

Except for this very serious incident involving the Academies' staff member, American participants in these exchanges have been treated very well in Iran. Relationships with many Iranian scientists have been developed that can benefit international science and also can help establish an environment for improved relations between the peoples of both countries. It is the hope of the U.S. National Academies that clear assurances will be received soon from Iran that will permit our institution to resume scientific visits to Iran.

December 26, 2008

Appendix F

Joint Statement on Science, Ethics, and Appropriate Uses of Technology (2009)

Joint Statement by Participants of the U.S.-France-Iran Workshop

Convened under the hospitality of the Fondation des Treilles, participants from the three countries engaged in discussions on scientific ethics, limited to the areas of biotechnology, cyber technology, and nanotechnology. While differences in perspective, such as the foundations of ethics, should not be minimized, the participants were pleased at the mutual recognition of large areas of common understanding. The participants, as individuals, associated themselves with the common understandings described here.

It is undeniable that science and technology have had a positive effect on human life throughout history. The rate of progress of science and technology is rapidly increasing, with a corresponding increase in its effect on human society.

Scientific advances are achieved by people of all nations, irrespective of political belief, religion, and ethnicity. The results of scientific research are a common heritage of humankind and, as a general principle, should be openly available to serve all people equally. Furthermore, scientific openness and freedom of inquiry are essential to the advancement of science itself. While some secrecy in the contexts of private intellectual property or national security is inevitable, these should be exceptions, and not the rule.

There are also cases where "dual use" scientific or technological advances have the direct possibility of being used maliciously against the common good. These cases raise the difficult issue that humankind may be better

served by exceptional restrictions on the production or dissemination of such results than by the general standard of openness. There is a need to achieve international understanding of what should be the boundaries and norms for these exceptional cases. Such understanding will require open discussions not only among natural scientists, but also with social scientists, policy makers, philosophers, humanists, ethicists, and religious thinkers.

There is a useful place for codes of conduct or ethics, developed by scientists, engineers, and physicians for their disciplines, on both national and international levels. Academic organizations, professional societies, academies, and international organizations should take active roles in the development and implementation of such codes. International codes may allow culturally appropriate differences in practices in different countries. Such differences, however, should be matters of public international discussion, in order to further mutual understanding across cultures and the convergence of international norms.

Standards of ethical behavior should be a part of science, engineering, and medical education. Many values such as objectivity, honesty, fairness, transparency of process, openness of results, and conscience are universal in science. These must be propagated as intrinsic to science at all educational levels. Countries, institutions, and individuals should be encouraged to exchange best practices in this area. International standards for curricula in science ethics should be encouraged.

Appendix G

Workshop Proceedings and Informal Reports

Proceedings Published by National Academies Press

The Experiences and Challenges of Science and Ethics, 2003
Water Conservation, Reuse, and Recycling, 2005
Food Safety and Foodborne Disease Surveillance Systems, 2006
Foodborne Disease and Public Health, 2008
Science and Technology and the Future Development of Societies, 2008
Science as a Gateway to Understanding, 2009

Proceedings Published by Iranian Academy of Sciences

Higher Education, 2004
Ecology of Caspian Sea, 2004
Drought Forecasting and Management, 2006

Proceedings Published by Other Organizations

Ecological Problems of the Caspian Sea, Russian Academy of Sciences, 2002
Roots and Routes of Democracy and Extremism, University of Helsinki, 2006

Improving Earthquake Mitigation through Innovations and Applications in Seismic Science, Engineering, Communication, and Response, Pacific Earthquake Engineering Research Center, University of California, Berkeley, 2009

Towards New Solutions in Managing Environmental Crisis, University of Helsinki, 2010

Earthquake Science and Engineering, Sharif University of Technology, 2010

Water Management in Iran and the United States, Rosenberg International Forum on Water Policy, University of California, Davis, 2010

Informal Collections of Papers Distributed by the National Academies

U.S.-Iranian Cooperation in Addressing Global Issues, 2003

Science, Ethics, and Appropriate Uses of Technology, 2010

Appendix H

Selected Statistics: Human Development, Research, and Communications in Iran

Human Development

Adult Literacy Rate (1995-2005)	82.4 %
Youth Literacy Rate (1995-2005) age 15-24	97.4 %
Population Undernourished (2002-2004)	4.0 %
Population Using Improved Water Sources (2002-2004)	94.0 %
Public Expenditure on Education (2002-2005), % of GDP	4.7 %
Public Expenditure on Education (2002-2005), % of budget	22.8 %
Public Expenditure on Health (2004) % of GDP	3.2 %
Electrification Rate	97.0 %
Unemployment (1996-2005)	11.5 %
Employment in industry (30%), agriculture (25%), services (45%)	

SOURCE: U.N.D.P. Human Development Report, 2007/2008

Research

R&D at Universities

Research Centers Associated with Universities: 165
Public Universities that Conduct Research: 53
Private Universities that Conduct Research: 23

R&D at Government Facilities

National Research Centers of Ministry of Science, Research, and Technology: 29
Research Centers of Ministry of Health and Medical Education: 99
Research Centers of Other Ministries: 69

R&D at Business Enterprises

R&D Units in Industry: 925
Private Research Centers: 113

SOURCE: Vice Minister Mansour Kabganian, Ministry of Science, Research, and Technology, "Science and Research Policies and Some Related Action Programmes for Sustainable Development of Iran," Dr. M. Tavakol, Editor, *Regional Forum on Science and Technology Policy for Sustainable Development,* 21-23 January 2006, Tehran, Iranian National Commission for UNESCO, Tehran, 2006.

Communications

Telephone Lines

International: submarine fiber optic cable to UAE with connection to Fiber-Optic Link Around the Globe (FLAG); fiber optic line from Azerbaijan through Iran to Turkmenistan with expansion to Georgia and Azerbaijan; HF, radio, and microwave radio relay to Turkey, Azerbaijan, Pakistan. Afghanistan, Turkmenistan, Syria, Kuwait, Tajikistan, and Uzbekistan; 13 satellite earth stations (2007)

Domestic: 25 million lines (2008)

Telephones

24.8 million main line and 43 million mobile cellular

Radio Broadcast Stations

72 AM, 6 FM, and 5 shortwave (1998)

Television Broadcast Stations

29 plus 450 repeaters (1997)

Internet

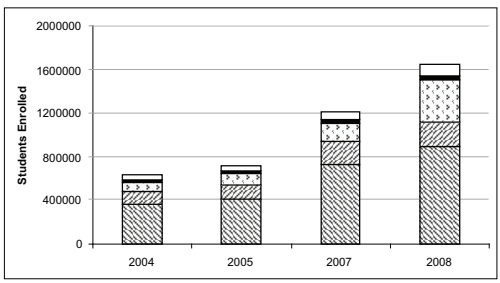
Hosts: 5.3 million (2006)
Users: 23 million (2008)

SOURCE: World Fact Book 2010: *http://cia.gov/library/publications/the-world-factbook/geos/ir.html*

Appendix I

Statistics on Higher Education in Iran

These data include university students at all levels—candidates for associate, bachelor, master, and doctoral degrees—but do not include medical students. Students included in this dataset are enrolled in universities that are accredited by the Ministry of Science, Research, and Technology. It has been estimated by an American scholar that more than 90 percent of Iranian universities have such accreditation. Azad University, with several hundred units throughout the country and an enrollment between 1 and 1.5 million students, is clearly not included in the data.



Agriculture & Vet	51626	55143	69282	105158
Arts	17257	17625	35735	37111
Engineering & Tech	88984	106569	169893	381490
Basic Science	119091	133868	209392	237609
Humanities & Social Science	356329	406036	724063	884282

SOURCE: Ministry of Science, Research, and Technology's Institute for Research and Planning in Higher Education: *www.irphe.ir.*