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The United States and Iran: Gaining and Sharing Scientific Knowledge through Collaboration

Irene Anne Jillson

IN biomedical and behavioral science—as in other fields—scientific discovery, and the resulting technology development, can derive from individual research endeavors. But often, the most significant scientific advances require a team and international cooperation.

Engaging in collaborative research across borders is not new. Even in the midst of the Cold War, the collaboration between Albert Sabin of the United States and Mikhail Chumakov of the USSR on the polio vaccine contributed importantly to the near-eradication of this disease today.

The recent rapid acceleration of international collaboration, however, is notable. U.S. Under Secretary of State Robert Hormats wrote, in commenting on the 136 percent increase in coauthored articles from 1985 to 2007, "Scientific collaboration is exciting because it takes advantage of expertise that exists around the country and around the globe."¹ This increased collaboration and globalization of science has been facilitated by both technological developments—including rapidly accelerating advances in information and communication technology since the mid-1970s—and the recognition by national and international funding agencies of the advantages of multinational research.

Historically, Persia, now Iran, has been a rich center for advances in biomedicine and health sciences, and synthesis and dissemination of medical knowledge

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have been a hallmark of medical science in Iran since the ninth century. The many and varied medical discoveries and advances in the tenth and eleventh centuries of Avicenna helped set a foundation for the modern advances in organ transplantation, neuroscience, and biomedical engineering. In the ninth century, Ali Ibn Rabban Tabari wrote the first “medical encyclopedia”—a compendium of traditions of medicine as known at the time. In the ninth and tenth centuries, Abu Bakr Mohammad Ibn Zakariyya al-Razi’s medical treatises, from compilations of existing medical knowledge to those describing his own discoveries such as that related to smallpox and measles, were widely translated into Latin and used throughout the Western world.

Much of the international scientific collaboration, irrespective of the degree of collaboration across disciplines, has been between North American and European countries, and increasingly between them and the so-called BRIC emerging economies (Brazil, Russia, India, and China). The initiatives to link science and diplomacy in the latter half of the twentieth century² paved the way for more recent collaborations, including those between the United States and Iran over the past decade. Norman Neureiter and Glenn Schweitzer noted that “The Department of State, as well as the Iranian government and many members of the scientific communities in the two countries, has taken the position that science-related engagement can contribute to solutions of global problems and also help improve understanding of each country’s society and politics.”³ While engagement between the United States and Iran is not without barriers, it has continued because of goodwill and keen commitment to knowledge development and dissemination on the part of many scientists in both countries.

Recently, the National Science Foundation identified the documented output of science and engineering articles published by Iranian scientists as the “first globally” with respect to growth, with an annual growth rate of 25.2 percent.⁴ The same report points to increases in coauthored articles between Iranian scientists and those in fourteen of eighteen European countries included in the review, with the Netherlands, the UK, and Norway as the only countries with which coauthorship decreased. There also was also an increase in articles coauthored by U.S. scientists from 2002 to 2008.⁵

This rich history and continued developments in Iranian medical science present an opportunity for collaboration between medical and health scientists in the United States and those in Iran, and indeed—notwithstanding the political discord between the two countries since 1979—collaboration has continued. This collaboration has been fostered through a number of mechanisms; in the United States, the American Association for the Advancement of Science (AAAS, publisher of *Science & Diplomacy*), the National Academy of Sciences (NAS), and the National Institutes of Health (NIH) have advanced these efforts. These organizations have fostered formal and informal exchange of scientists, clinicians, bioethicists, and others, resulting in collaborative research that has contributed to important gains in knowledge of a range of medical and health conditions and concerns.

Examples of U.S.-Iranian Collaboration in the Medical and Health Sciences

Food-Borne Diseases

At the turn of this century, the NAS, a private, nonprofit society of scientific and engineering scholars, embarked on an innovative program designed to engage U.S. and Iranian scholars in engineering, health, and science in discourse regarding common issues. While the initiative's activities covered multiple issues, ranging from earthquake science to higher education challenges, NAS prioritized food-borne disease, with particular attention to disease surveillance and approaches to addressing food contamination.

The activities comprised workshops, joint planning meetings, individual exchanges, and a three-year pilot project related to food-borne disease surveillance carried out in Iran. More than five hundred scientists representing eighty institutions in the United States and Iran were involved during the first decade of the initiative. The NAS also reports that hundreds of additional scientists in the two countries met with their scientific peers during the visits and that thousands of others were present, in person or virtually, at scientific lectures.⁶

Food-borne disease is a significant problem in both Iran and the United States. Indeed, the prevalence of food-borne infection in the United States is staggering. Researchers recently estimated that each year "31 pathogens caused 37.2 million illnesses, of which 36.4 million were domestically acquired; of these, 9.4 million were foodborne."⁷ During the spring and summer of 2008, an outbreak of *Salmonella serotype Saintpaul enteritis* sickened 1,407 individuals across 43 states, Washington, DC, and Canada, resulting in two deaths and 282 hospitalizations. Because of a link to tomatoes cultivated in the Southwest, consumers stopped buying tomatoes, costing the industry approximately \$200 million.⁸ In Iran in 2006, twenty-six outbreaks of food-borne illness were reported, affecting five thousand individuals and resulting in eleven deaths. One study commented on reasons for Iranian outbreaks: "Food production, processing, marketing, and distribution take many forms in Iran. Much of the food handling occurs locally, at the village level, where it is difficult, if not impossible, to implement inspections and other measures to prevent foodborne illness."⁹

Two workshops were held, one in Tehran and one in Washington, DC. During the workshops, scientists from the two countries visited universities and research institutes and other sites relevant to food-borne disease (such as slaughterhouses in Iran) and met with individual scientists, policy makers, and others involved in food-borne disease surveillance and other facets of food safety. An important outcome of these meetings was a pilot project on food-borne diseases.

From 2005 to 2007, the Research Center for Gastroenterology and Liver Disease at Shahid Beheshti University of Medical Sciences in Iran carried out a pilot project in collaboration with an expert from the Oregon Department of Human Services.

From March through May 2007, the researchers collected data in an area northeast of Tehran. The objectives of the project were to estimate the incidence of diarrhea; determine the etiology of reported diarrhea; detect and investigate food-borne and other common-source outbreaks; and assess trends over time.¹⁰ The project was systems-focused and benefited from the standardized organizational structure throughout Iran (given its national health system). This facilitated the introduction and implementation of approaches to strengthening surveillance and other processes related to protecting the public from food-borne diseases.¹¹ Based on discussions held at a follow-up workshop in 2007, it was suggested that “the major strength of the pilot project is that, as the first Iranian effort to include both field and laboratory capacities, it provides a good starting point from which to improve the foodborne disease surveillance system in the country.”¹²

The discussions during the workshop pointed to opportunities for strengthening approaches to preventing food-borne diseases and responding to outbreaks in both countries. Participants suggested the creation of innovative means to address practical problems faced in the two countries. These could address both structural issues, such as reporting mechanisms, as well as the dissemination of vital information to public health and other health providers regarding responses to outbreaks, through, for example, the open source Internet library supported by the World Health Organization and to which U.S. and Iranian scientists, among others, have contributed. The innovative and effective approaches discussed during these workshops can contribute to addressing this growing and quite serious global public health problem.

Neuroscience and Drug Abuse Research

Recently, neuroscience has been a particularly fruitful area of Iranian scientific research. Neuroscience, which is a quintessential example of multidisciplinary research, ranging from clinical and basic sciences to language and intelligent systems, has been the basis of significant developments in neurophysiology, neuropharmacology, and neurosurgery. A recent study of Iranian contributions to international publications in neuroscience found substantial contributions from 2002 to 2008, with most of the coauthored publications by Iranian and developed country scientists being with U.S. scientists.¹³ Neuroscience research has the potential to yield important findings that can inform prevention and treatment of widespread conditions that affect global populations, such as Parkinson’s disease, Alzheimer’s disease, addictions, and mental diseases such as psychotic disorders.

Opiate use, also an increasing public health scourge globally, can have a devastating impact on individuals, families, communities, and society. Further understanding of the etiology of this disease and the protective and risk factors that can be used as a basis for prevention and treatment is of upmost concern to policy makers and health officials in the United States, Iran, and worldwide. American and Iranian scientists have undertaken collaborative drug abuse

research for more than a decade. This research has had an important impact in Iran, including contributing to the establishment of drug abuse treatment programs throughout the country, an increased understanding of women and drug abuse,¹⁴ and participation by Americans on the board of Iranian health research journals (for example, the *Quarterly Journal of Addiction*).

Noncommunicable Diseases

Given the global prevalence of esophageal cancer, diabetes, and opiate addiction, scientific collaboration can contribute significantly to prevention and treatment of these conditions. Chronic diseases, including cancer and diabetes, are now the primary causes of morbidity and mortality in the developing world, as they have been in the United States and other high-income countries for some time. Globally, esophageal squamous cell carcinoma is the most prevalent form of esophageal cancer. In the United States alone, 28,989 cases of squamous cell esophageal cancer were diagnosed from 1999 to 2004.

In 2004, after completion of a pilot study, a comprehensive cohort study was initiated to investigate the causes of esophageal squamous cell carcinoma in Golestan Province in northeastern Iran. This area was selected because it has among the highest rates of this type of cancer in the world. The study population comprised 50,045 individuals ages forty to seventy who were recruited from January 2004 through June 2008.¹⁵ Experts from the National Cancer Institute participated in the study, which included collaboration among universities in Iran, France, Sweden, the UK, and the United States. Over the course of the study, the researchers took advantage of the strong study design to explore other health problems among the population in this low-resource area, including opium use and diabetes mellitus and its correlates.¹⁶

This study has yielded a remarkably rich body of knowledge with respect to these diseases and health conditions—including the risk and protective factors related to them. Among the findings are associations between esophageal carcinoma and dental health and oral hygiene habits and gastric atrophy,¹⁷ and esophageal cancer¹⁸ and a pattern of food and nutrient consumption,¹⁹ including tea drinking habits.²⁰ The study has also yielded important findings with respect to medical research methodology, including the validity and reliability of a food frequency questionnaire developed for the pilot phase of the study;²¹ reliability and validity of opiate use that is self-reported;²² and reliability and validity of verbal autopsy (in which an interview is conducted with an individual who knew the deceased well).²³ The contributions made by this collaborative, interdisciplinary study to these widespread chronic conditions represent a quintessential example of the importance of scientific exchange that traverses geographic and political boundaries to address shared concerns.

From Iran to Mississippi: Addressing Health Disparities Using the Iranian Community-Based Health Model

In 2009, after initial contact between American and Iranian primary health clinicians, health researchers and other health professionals, a remarkable collaborative effort was initiated to improve the health status of low-income populations in the Mississippi delta. Mississippi ranks fiftieth of the fifty states with respect to full immunization coverage and availability of physicians, and its cardiovascular mortality rate is the highest in the country. The population living in the delta region in particular has significantly poorer health status than others in Mississippi and in comparison with the U.S. population overall. A few indicators are particularly notable: in 2009, the maternal mortality rate per 100,000 live births was 30.4 in Mississippi, double the rate of 15.0 in the United States overall and higher than Iran's maternal mortality rate of 25.0; 70.6 percent of Mississippi's population was overweight or obese, compared with 66.8 percent of the U.S. population overall and 46.8 percent in Iran; and 15 percent of adults ages twenty and over in Mississippi had been diagnosed with diabetes, versus 11.9 percent for the United States overall and 8.7 percent in Iran.²⁴

Since the mid-1980s, Iran undertook to significantly improve the health status of its population and in particular those living in more isolated rural areas. The Iranian constitution guarantees access to health services, which are provided primarily through the Ministry of Health and Medical Education, although extensive private services are available as well. A key pillar of the national health system was the "Health House Concept." This comprises a primary care center from which community health workers (known as *behtarz*) serve the village in which they live, delivering a wide range of gratis, integrated health services. As a result of this innovative system of care, key health indicators for the rural population had improved significantly by 2010. For example, immunization coverage among children improved from 10 percent for BCG and 33 percent for DTP to 95 percent and 98 percent, respectively; immunization coverage of pregnant women increased from a little below 4 percent to 85 percent. Overall, primary healthcare access improved from 15 percent to 86 percent.²⁵

The initiative to improve health status in the Mississippi delta region, based on the success of the Iranian Health House Concept, involved collaboration between the Shiraz University of Medical Sciences and a consortium of Jackson State University, Jackson Medical Mall Foundation, and the Oxford International Development Group. This interdisciplinary team carried out a situation analysis in the Mississippi delta by conducting focus groups with health professionals and community members; observing primary care service delivery; analyzing relevant policies and regulations of the U.S. healthcare system; designing a service package based on the needs assessment; identifying equipment, facility, and other needs by carrying out a locational analysis for the health houses; and designing a training curriculum.²⁶ The collaborating organizations have plans for fifteen health houses

and are seeking funding for them. In the meantime, eleven health houses are operational in schools, staffed with nurse practitioners whose services are billed to Medicaid. According to a recent *New York Times* article, the health and monetary benefits of the health house concept, including straightforward integration of services and a focus on preventive and primary care, is already apparent.²⁷

Bioethics: Shared Concerns, Shared Values

Bioethics is another area in which there has been increasing exchange between the United States and Iran, and between these two countries and others. American bioethicists and biomedical researchers have been keynote speakers in international conferences held in Iran and have spoken at Iranian universities and research institutes, while Iranian bioethicists, researchers, and clinicians have visited and lectured at U.S. universities and other research institutions. This has resulted in contributions to the discourse as well as plans for joint publications, participation on the part of Americans in review of master's degree PhD dissertations, and plans for visiting scholar arrangements.

This topic has become important for scientific exchange. In all countries, biomedical scientists, clinicians, individuals and family members, and policy makers face tough ethical questions daily that require thoughtful, transparent, and clear discourse. The issues range from preventing and confronting pandemics—including HIV/AIDS and the H1N1 and avian influenza viruses—to pharmacogenomics, from organ transplants to neonatal intensive care technology, from stem cell research to end-of-life decisions, and from access to basic healthcare to addressing high-risk behaviors such as tobacco and opiate addiction. Addressing these issues provides opportunity for dialogue. The NIH Human Genome Project, the United Nations Educational, Scientific and Cultural Organization (UNESCO), and other entities have promoted such dialogue. An increasing number of individuals from countries at political odds with each other are engaging in bioethical dialogue. Bioethicists at Jesuit colleges in England, for example, are engaged with counterparts at Islamic colleges in Qom, Iran. This is understandable: all healthcare practitioners, policy makers, and ethicists face comparable health problems at the clinical, institutional, and national and international policy levels, and have common bases, such as the UNESCO principles, for addressing them. Yes, there are differences with respect to philosophical and spiritual approaches, but discourse regarding these differences is both healthy and instructive. The abstracts from the Second International Congress of Medical Ethics in Iran tell the story: there are more similarities than dissimilarities in the discussion of complex bioethical issues. Shared values with respect to sanctity of human life, responsibility for protection of vulnerable populations, and the imperative to do no harm are common threads throughout.

U.S. and Iranian bioethicists have much to share now, and indeed the intellectual exchange between Iran and Europe has been in place for some time. The Iranian

Islamic scholar and religious leader Abu Bakr Mohammad Ibn Zakariyya al-Razi created the first set of basic standards for medical ethics. Principlism, considered by many to be the foundation for the most common set of bioethics concepts and guidelines currently in use, was conceived and described in the United States in the middle of the twentieth century and has influenced a generation of Iranian bioethicists. They, and their American colleagues, are now engaged in dialogue about the new frameworks of bioethics and healthcare ethics that have been developed over the past decade by ethicists, social scientists, and healthcare professionals in a wide range of countries. Effectively, these new approaches to considering “basic” ethical principles are informing decisions as complex as the urgency of meeting the needs of low-income populations in the Mississippi delta in the United States to reducing the high incidence of esophageal squamous cell carcinoma in Golestan Province, Iran.

Future Collaboration

The collaborations discussed above and other similar projects have been possible on the U.S. side because of the commitment on the part of the senior leadership in nongovernmental and governmental organizations such as the AAAS, NAS, NIH, and the U.S. Department of State. Even more importantly, faculty members and researchers in universities and research centers in both the United States and Iran have also supported these collaborations. The most long-standing collaborations have been sustainable because of this dedication and because they engaged good scientists working on issues that were of importance to both countries.

The resulting work has yielded important, wide-ranging benefits in areas such as health services delivery, food-borne diseases, neurosciences, water and sanitation, ophthalmology, and bioethics. Such collaborations are important for the health of the populations of both countries and beyond, as the diseases and conditions they address have wide geographic distributions and implications. The collaborations have also contributed to understanding and improvements in scientific methodologies, such as in epidemiological research, in which the findings are applicable for a wide range of medical science research globally.

Science engagement is valuable in many areas. Efforts in the health sector are highlighted in this article because of the personal immediacy and both individual and societal importance of health issues at all life stages, for everyone. As was noted in a 2006 editorial in the *Lancet*, the global interest in health can be used as a basis for forging partnerships among policy makers, scientists, and clinicians in Europe, the United States, the Middle East and North Africa, and other regions.²⁸

This could, perhaps, avert viewing interactions between countries through a prism of violence and, rather, encourage engagement in medical and health science research with a shared goal of improving the health of individuals and whole populations. Given the complex and adversarial relationship between

the United States and Iran, and the resulting scant interaction between the two countries for more than thirty years, finding mutually beneficial areas of cooperation has great value. It is important that policy makers on both sides, while working through the broader political challenges, encourage and support efforts that lead to greater health research collaboration. The opportunities for collaborative engagement are boundless and have the potential to yield life-saving results not only in the countries where the engaged scientists work, but also far beyond those borders. **SD**

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