COMMENTARY

Restrictions on Travel: No International Exchange, No Science

Irving A. Lerch

The most oft-quoted pro-science declaration of 2001 is Allan Bromley's March 9 ***New York Times*** Op-Ed which concludes with, "No science, no surplus. The assumption on which Allan's statement stands is that funding is needed to nourish a well-lubricated machine to convert intellectual capital into new science and which, in turn, transforms technological innovation into economic expansion. The problem is that ill-considered legislation and State Department policies and procedures threaten to throttle the international intellectual exchange on which our scientific and economic prosperity depend.

The US domestic science enterprise is part of a global machine whose bells and whistles bear the many labels of widely varying national origins. Thirty-five percent of all doctorates granted by US institutions in the natural sciences and engineering go to foreign scholars and this is roughly the same as the percentage of foreign scientists resident in US research universities. Cut off this source of erudite input and the machine grinds to a halt. This may be happening now.

In the immediate post-war era, roughly 70% of the world's research productivity in the natural sciences originated in the US. This was the result of the fact that the world's scientific talent gathered in this country to exploit the largest and most unique research facilities available in a planet devastated by war. Today, when 70% of the articles published in ***The Physical Reviews*** are proffered by foreign authors, US submissions have become a declining minority presence in a formerly largely domestic publication once dominated by US physicists.

Of course this is not quite true. It is not possible to portray domestic US science as a purely nationalist venture. As a nation of immigrants, our academic community has benefited from the talents and educational systems of many nations. This constant renewal is largely responsible for the wealth and power of the US. In sum, the capacity of US science is directly related to its efficiency at integrating new talent and in its participation in the worldwide intellectual commerce. Does this mean that we cannot develop native-born scientists? Have we arrived at the point in our national lives that we have to import scientists along with farm workers and day laborers?

The fact is that science has done a dismal job in nurturing and exploiting the talents of native-born minorities and women. And we've done little better in recruiting young people owing to a failing educational system. While recruitment in some of the natural sciences has increased the training of women–especially in biology and medicine, we have not cleared the obstructions preventing the elevation of the most senior and talented to positions of authority. Even if we succeeded in training more minorities and women as scientists, would that solve the problem?

No. We may be able to increase domestic recruitment by a few percent, but in the absence of an overhaul of the nation's education system, we could never hope to match the large numbers of scientists who come to this country to receive advanced education, do research and develop new ideas. Does this mean that we must engage in predatory recruitment of intellectuals and denude developing and re-developing countries of their talent, thereby diminishing their prospects for economic improvement? No. We must fashion a world where global intellectual transactions–like monetary and commercial arrangements (at least as they now exist among the industrialized nations)–benefit all participants. We must have an international system where scientists may freely work with colleagues anywhere for the benefit of all.

Problems with visas

The process of acquiring visas is the valve regulating the flow of scientific talent into the US. In the past, the single most important hurdle to the granting of visas has been economic and the fear of illegal immigration as defined in various subsections of paragraph 214 of the Immigration and Naturalization Act. However, a complex array of provisions affixed to the INA has sought to reduce the flow of industrial and defense technologies to competitors by restricting scientific exchange. Many of these provisions require scientific and technical expertise to account for the fact that both our economic and defense technologies are dependent on foreign exchange—that to impede such information flow is to do injury to our own economy and security. The law and it administration do not have mechanisms or expertise to weigh risks in the national interest. The reasons are easy to enumerate:

- Consular officers in our embassies and consulates abroad usually do not have the background to judge scientific credentials or the value of a scientific visit. Scientists seeking entry to the US are treated in the same manner as all visitors—business, tourist or job applicant.
- There is ambiguity and confusion concerning the guidelines for enforcing provisions of the INA. Many US universities and national laboratories employ expert staff to deal with visa problems. But their interactions with consular officials are punctuated with inconsistencies in interpretation of regulations and law. And since consular officials are held accountable, it is safer and easier for them to deny an application than to examine the facts and to adjudicate on the basis of merit.
- The advent of the "sensitive countries list," (countries assumed to be engaged in activities counter to US interests) the "entities list," (the list of institutions deemed to have violated US non-proliferation statutes), export control regulations (to include such vague concepts as "deemed exports" and "sensitive but unclassified information") have given the Department of State an impossible task: to monitor and prevent the flow of scientific and technical information deemed critical to the economic and defense interests of the US. Not only do these contradictory and obscure provisions lead to delays and obstacles impeding scientific exchange, they often impose the ludicrous circumstance of impairing the exchange of information developed by foreign

colleagues–information essential to the progress of science. The task of processing requests for entry visas often falls to an interagency task force, which imposes an additional bureaucratic layer on the evaluation mechanism without adding any illumination.

These problems have created difficult conditions for our national labs. There has been an ongoing effort to convince foreign governments and institutions to make substantial investments in large programs. The US has then made it difficult for foreign colleague sto participate in on-site experiments because of restrictions in our visa laws, which make no provision for open-ended scientific visits. The labs have often faced the ludicrous situation where a scholar representing a foreign university is denied admission to participate in an experiment funded by that university!

There are other obstacles: high fees for some visas in retaliation for charges imposed by other governments ("Reciprocity Schedule" reprisals) and severe restrictions preventing host institutions from reimbursing visiting scholars (primarily those participating in research programs at government laboratories who incur travel and subsistence expenses associated with their work in the US).

Among the more important factors contributing to the success of US science has been the recruitment of foreign graduate students. Large numbers of Chinese students have been a vital factor in invigorating physics programs around the nation. In recent months, however, visas have been routinely denied because these students are unable to demonstrate binding ties to their country. This means that they do not have an academic or research appointment in advance of their completion of graduate studies!

The international standard of free exchange

The International Council for Science is a global structure of disciplinary scientific unions such as the International Union of Pure and Applied Physics, Chemistry, Crystallography, etc. In the period between the world wars, before the advent of the International Council, adherence to many of the international disciplinary unions was vested in the Department of State. However, the system was wrested from government patronage and now resides with the Academies of Science in each member state. Thus, with the exception of China, Cuba and a number of authoritarian states, adherence to the international system is non-governmental. Nonetheless, each country must uphold the international standard for the free circulation of scientists–something almost impossible to achieve when the government restricts entry to foreign scientists. Failure to adhere to this standard is grounds for the international union to withdraw sponsorship from a scientific meeting.

For international union-sponsored meetings in the US, the National Academy of Sciences usually communicates with the Bureau for Consular Affairs requesting that our consular officers abroad be apprized that an international meeting is being organized and requesting the Department to expedite visa applications regardless of origin. For the most part this system has worked well. However, there are increasing signs that this arrangement may be weakening.

Treasury and Commerce embargoes

US scientists are routinely denied permission by the Treasury Department to travel to Cuba unless an international meeting is organized by an entity to which the US is a member but which is not headquartered in the US. While social scientists, anthropologists, climatologists and some others have been able to travel to Cuba with increasing frequency, many physical scientists have been denied licenses on often inconsistent and contradictory grounds. The US community views such restrictions with grave concern since it directly affects the freedom of citizens to participate in important cultural exchange of benefit to both Cuba and the US.

Applications for license are often complex and time-consuming with little feedback after submission. Attempts to track the progress of applications are often rebuffed. Rarely do government employees respond to inquiries or provide meaningful information.

Remedial actions

Last year, in response to language added to the State Department appropriations bill, a Science and Technology Advisor was added to the staff. The position is currently held by a senior scientist who has the trust and confidence of the US scientific community: Dr. Norman Neureiter. It is urgent that this office be strengthened and be given the opportunity to coordinate issues affecting entry of scientists into the US.

It is proposed that short and long-term scientific visas be processed under a new category of visa and that the Department S&T advisor work with both the Office of Science and Technology Cooperation in the Bureau of Oceans and International Environmental and Scientific Affairs, and the Bureau of Consular Affairs, to administer a coherent, effective policy to promote scientific exchange.

It is also proposed that the State S&T Advisor assist the Treasury and Commerce departments in dealing with visits of US scientists to embargoed countries. US science has maintained its international leadership by promoting scientific exchange. The unprecedented flow of intellectual talent into our country has continued unabated over the past half-century. This represents a huge contribution to both our domestic science enterprise and to our economy since innovations in science and technology have been shown to have a direct impact on our commercial expansion and development. In addition, some of the most important international scientific meetings are convened in the US and foreign participation in these events contributes to the centrality of

US science on the world stage. However, impediments to the granting of visas have burgeoned. Scientist visits have been curtailed and this has jeopardized a variety of programs dependent upon short and long-term visits. Scientists from the former Soviet Union, China, India and many developing countries have found it increasingly difficult to gain entry to the US to continue their research and collaboration with US colleagues. Even scientists from traditional allies such as Germany have been barred for reasons that defy explanation. If this situation continues to worsen, the center of gravity for important research may shift away from the US.

In their 1999 report, *The New Challenge to America's Prosperity: Findings from the Innovation Index*, the Council on Competitiveness issued a warning. *"Finally, the authors note that despite the advances of other nations, the United States is failing to invest in the 'fundamentals' of its own innovation system. Although the past decade has been one of the strongest periods of U.S. macroeconomic growth since World War II, total spending on basic research is flat or heading downward, and the declining numbers of degrees granted in the physical sciences and engineering suggest that reversing this trend will involve concerted public policy changes. These observations suggest that America's current innovation leadership is increasingly rooted in past investment and that the long run basis for our future strength is being eroded—all while other nations are accelerating their own efforts"*

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Our National Energy Situation is a Mess!

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(Invited oral testimony (limited to 5 minutes) given to the Subcommittee on Energy of the Science Committee of the U.S. House of Representatives, May 3, 2001, in Room 2318 of the Rayburn House Office Building in Washington, D.C).

For years we have seen recommendations from the Department of Energy that suggest that the leaders of the Department have little scientific understanding of the problems of energy.

We have seen the President of the United States sending his Secretary of Energy on bended knee to plead with OPEC leaders to increase petroleum production so as to keep our gasoline prices from rising. *For a country that boasts that it is the world's only superpower, this is profoundly humiliating.*

Gasoline prices are rising. California currently has an electrical energy crisis that is likely to spread. Natural gas prices are rising rapidly, which poses real economic hardship for millions of American home owners who depend on natural gas to heat their homes in the winter.

The only energy proposals we see are for short-term fixes, sometimes spread over a few years, that seem to ignore the important real-world realities of resource availability and consumer costs.

For years, scientists have warned that fossil fuels resources are finite and that long-range plans should be made. These plans must recognize that growing rates of consumption of fossil fuels will lead, predictably, to serious shortages that are now starting to appear.

For years we have heard learned opinions from non-scientists that resources are effectively infinite; that the more of a resource that we consume the greater are the reserves of that resource; and that the human intellect is our greatest resource because the human mind can harness science and technology to solve all of our resource shortages.

There seem to be *two cultures; science and non-science*. Each has its own Ph.D. "experts" and "think tanks." Each has its own lobbyists who argue vigorously that their path is the proper path to achieve a sustainable society. So let's compare the two recommended paths.

The centerpiece of the scientific path is conservation; hence it is appropriate to call this path the "Conservative Path." On this path the federal government is called on to provide leadership plus strong and reliable long-term support toward the achievement of the following goals. The U.S. should:

1. Have an energy planning horizon that addresses the problems of sustainability through many future decades.
2. Have programs for the continual and dramatic improvement of the efficiency with which we use energy in all parts of our society. Improved energy efficiency is the lowest cost energy resource we have.
3. Move toward the rapid development and deployment of all manner of renewable energies throughout our entire society.
4. Embark on a program of continual reduction of the annual total consumption of non-renewable energy in the U.S.
5. Recognize that moving quickly to consume the remaining U.S. fossil fuel resources will only speed and enlarge our present serious U.S. dependence on the fossil fuel resources of other nations. This will leave our children vitally vulnerable to supply disruptions that they won't be able to control.
6. Finally, and most important, we must recognize that population growth in the U.S. is a major factor in driving up demand for energy. This calls for recognizing the conclusion of President Nixon's Rockefeller

Commission Report (Commission on Population Growth and the American Future, 1972). The Commission concluded that it could find no benefit to the U.S. from further U.S. population growth.

In contrast, the non-scientific path suggests that resources are effectively infinite, so we can be as liberal as we please in their use and consumption. Hence this path is properly called the "Liberal Path." The proponents of the Liberal Path recommend that the U.S. should:

1. Make plans only to meet immediate crises, because all crises are temporary;
2. Not have government promote improvements in energy efficiency because the marketplace will provide the needed improvements.
3. Not have government programs to develop renewable energies because, again, the marketplace can be counted on to take care of all of our needs.
4. Let fossil fuel rates continue to increase because to do otherwise might hurt the economy.
5. Dig and Drill. Consume our remaining fossil fuels as fast as possible because we "need them." Don't worry about our children. They can count on having the advanced technologies they will need to solve the problems that we are creating for them.
6. Claim that population growth is a benefit rather than a problem, because more people equals more brains.

We should not be confused by the conflicting expertise that supports each of these two paths because there is a very fundamental truth:

For every Ph.D. there's an equal and opposite Ph.D.

For our U.S. energy policy, we must choose between the Conservative and the Liberal Paths. The paths are the exact opposites of each other. Each is advocated by academically credentialed experts. On what basis can we make an intelligent choice?

There is a rational way to choose. If the path we choose turns out to be the correct path, then there's no problem. The problems arise in case the path we choose turns out to be the wrong path. It follows then that we must choose the path that leaves us in the less precarious position in case the path we choose turns out to be the wrong one.

So there are two possible wrong choices that we must compare.

If we choose the Conservative Path that assumes finite resources, and our children later find that resources are really infinite, then no great long-term harm has been done.

If we choose the Liberal Path that assumes infinite resources, and our children later find that resources are really finite, then we will have left our descendants in deep trouble.

There can be no question. The Conservative Path is the prudent path to follow.

However, it is the Liberal Path that we are so eagerly taking today.

<u>If resources turn out to be infinite, then we will be OK on the Liberal Path. But if resources turn out to be finite, then today's choice of the Liberal Path will create enormous and critical problems for our children.</u>

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