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National Science Policy, Collaborative Research and the Advancement of Science

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ABSTRACT

The climate for collaboration between U.S. scientists and their counterparts in other countries has improved because of changes in national science policy and a new recognition by policy makers that international cooperation is needed. Today, advances in science are bringing scientists from many disciplines together. Previously, landmark discoveries spawned new subdisciplines. Policy makers are using many devices to facilitate collaborative efforts--funding problem rather than discipline centered initiatives, devoting more resources to research centers, guaranteeing stable funding over longer time periods, changing anti-trust laws, and encouraging collaborative research training. At the same time, economic necessity is causing the U.S. to look abroad for help in supporting the expense of science. Moreover, policy makers have begun to recognize that some of the problems they want to see scientists solve are of their nature international in scope and, therefore, require international collaboration if they are to be adequately addressed.

For the past ten years, I have been involved with the formation of U.S. science policy, first as science advisor to a member of the Science, Space and Technology Committee of the U.S. House of Representatives and most recently as the Washington representative for fifteen scientific societies and nearly half of the graduate departments of psychology in the United States. My work has allowed me to be both a participant in and an observer of changes in U.S. science policy, and it is those experiences I will use as the bases for my comments. I want to set the growth of interest in international scientific collaboration in the context of key changes in U.S. national science policy.

The past ten years have seen important changes both in the way science is carried out in this country and in the ways that U.S. scientists have been encouraged to interact with their counterparts in other countries. Each of these sets of changes has a bearing on the future of international cooperative efforts.

Changes in the practice of science in the United States in recent years have been driven largely by the successes of science. Across many disciplines, it is a common occurrence to hear scientists remarking in wonder about the progress of science. The field of psychology these days, for example, is being heavily influenced by research that once was confined to the subdiscipline of cognitive psychology. The breakthroughs in cognitive psychology came in part as the result of contact between cognitive psychologists and neural scientists. Their interaction has been making it possible to map cognition onto physiology. More and more, it is becoming possible

to study the brain and behavior together. The black box that just a few years ago psychologists thought they could study only indirectly by means of stimulus and response they are now peering into directly. That new found ability is affecting everything from the design of computers to our understanding of the relation between changes in brain chemistry and behavior across the life span. The mind-body dualism that has been problematic for scientists since the time of Aristotle and Plato may in our lifetimes begin to be resolved. And psychology is just one of many sciences experiencing this kind of rapid progress.

For science policy, what is significant about many of these spectacular advances is not so much that they are happening but how they are happening. Whether one listens to scientists at the National Science Foundation, the National Institutes of Health, or the Defense Department, the story is the same. When they reflect on their work, they note that as a subdiscipline advances, scientists within the subdiscipline eventually reach a point where their own paradigms, protocols, even equipment fail them. They reach a point where they know that the next advance in their subdiscipline can come only by reaching beyond that subdiscipline to areas of science, and, often, areas of engineering that are outside their own training. Sharing of information across disciplinary boundaries and outright collaboration across disciplines becomes not just an interesting concept, but an absolute necessity in order to continue to advance. This impact of new discoveries on the practice of science is a change from the previous era. Science went through a long period of differentiation when significant discoveries spawned new scientific disciplines. Now discoveries at the cutting edges of the sciences are drawing the sciences together rather than breaking them apart.

Those who make U.S. science policy have been well aware of this change in the relationship between new discoveries and the nature of scientific practice. They have been striving to find ways to stimulate broad scientific collaboration. Out of that effort have come a number of innovations in national science policy.

Until the 1980s, antitrust laws originally designed to keep companies from forming monopolies also had the effect of discouraging collaborations among the research divisions of the nation's corporations and between industry and the university. Those laws were relaxed in a series of legislative reforms in the 1980s. As a result, U.S. companies, most notably in the semiconductor industry, have formed research and development consortia. At about the same time as the changes were being made in antitrust law, the Small Business Innovation and Research Grants were put into place in most of the science-related agencies of the Federal government. These grants have begun to make university faculty partners with their academic institutions in research and development. A number of universities have formed venture capital arms to further encourage such joint efforts.

Perhaps the most important policy change, however, has been the movement toward funding a more balanced mix of individual investigator initiated research and research conducted through research centers. The growth of centers as a means for funding research has been a direct result of the desire on the part of policy makers to create institutional settings that encourage scientific collaboration across disciplines. The only center proposals at the National Science Foundation that move beyond in-house examination to peer review in the Science and Technology Research Centers competition are those that propose innovative ways to

bring a diversity of scientists together around a problem. It is also a requirement that the proposal contain a strong training component. It is significant that the peer review panel for the centers contains scientists of every stripe from geologists to social scientists. The nature of science is changing and governmental mechanisms are changing to accommodate and stimulate the evolution.

That training is a central part of the Centers program is also significant. Policy makers understand that the new science requires new scientists. There has been anxiety both among policy makers and among scientists in the cutting edge sciences that the classic division of universities into departments and of departments into subdisciplinary groups will be inadequate for training scientists to be skilled collaborators. That is why the Centers device is being used as a new mode of training. It is often said that the best way to train a scientist is to involve the person in scientific research. Policy makers have merely extended that axiom to say that the best way to train a scientist to collaborate is to train him or her in a collaborative research setting.

By design, the Centers competition requires scientists to organize around a problem. The government by degrees is shifting itself away from supporting disciplines of science for their own sake. It is shifting toward supporting science as a problem solving tool. The government is trying to break down the walls between disciplines by forcing scientists with a diversity of training to come together to solve problems. If one looks at the areas of the Federal science budget that have received the greatest increases, they are more and more often not related strictly to favored disciplines but rather to practical initiatives that involve many sciences. The AIDS initiative, for example, involves the whole of the Public Health Service from those branches that deal with delivery of services to most Institutes within NIH to all the Institutes of the Alcohol, Drug Abuse and Mental Health Administration. The complexity of the initiative is such that not only has it brought together many kinds of scientists and service providers, it has also required the creation of an interagency coordinating body to try to achieve an effective integration of the various efforts.

Other adjustments policy makers are instituting to encourage collaborative, problem focused science include multi-year science authorizations to allow the stability that building joint research programs requires. The movement toward multi-year program authorizations is being accompanied by greater stability in funding of those programs. While the appropriations process remains an annual activity, agencies are being permitted to make multi-year funding commitments for certain activities such as centers so as to guarantee those involved in the collaboration sufficient time to develop a strong research program.

So at the national level, we see policy makers conceiving of the new practice of science as being one that will advance through collaborative efforts. Those efforts will routinely require scientists to cross disciplinary boundaries both in their own training and in their research associations. This new science will be one organized around problems or initiatives rather than disciplines. More of it will be conducted in group research settings. It will require greater attention than has been the case since the end of World War II to establishing and maintaining a continuum from basic research to development to testing to evaluation and finally to application.

All of these changes can be and are being implemented domestically. But they, along with two other aspects of changing national science policy, also are playing a

strong role in creating a climate in the U.S. that is favorable to international cooperation in research. The first of these two other aspects is the growing recognition that the United States cannot be the leader in every field of science. The second is that many of the most significant problems the United States would like to call on scientists to help solve are global in their scope. Their very nature precludes a solely domestic solution.

I should say that these two developments have been very recent events. Beginning in the Carter years and continuing through most of the Reagan years there was a great deal of concern in Washington that other countries were taking advantage of our research, particularly our classified and our proprietary research. There were efforts to censor papers that were to be presented in conferences. There were restrictions on classes that foreign nationals could attend at some universities. The United States withdrew its support of UNESCO. Scientific exchange agreements were negated as ways of showing displeasure with policies of other countries. And the Congress drastically reduced Federal funds available for scientists to attend international meetings and to work with scientists from other countries.

The change to a more favorable attitude, as I say, is recent, and it has occurred for not particularly noble reasons. The idea that the United States cannot be first in all sciences was thrust upon policy makers by economic reality. The cost of scientific research is rising rapidly and is taxing the ability of the Federal government to pay the bill. As a result, the United States is becoming much more interested in sharing the costs of research with other countries. This is especially true of large ticket items like construction and maintenance of the space platform, the search for a cure for AIDS, and perhaps even maintenance of the Superconducting Supercollider. Even though the motivation may, at base, be economical, the change in attitude nevertheless is again making U.S. scientific collaboration with other countries a favored rather than a suspect activity.

While it is becoming economically prudent for the United States to share in the strong research and the research resources of other countries, the recognition that many of our most challenging research problems are global in scope and, therefore, require global collaboration was harder for the U.S. to accept. While European leaders had become deeply concerned about the need to understand global changes some years ago, the United States was late to join in this interest. Our conduct with respect to Canada over the acid rain issue suggests the source of our reluctance. It is likely that the United States is a significant part of the problem of global change, and, therefore, its participation in finding ways to moderate dangerous global changes is likely to carry with it very significant costs. That possibility notwithstanding, President Bush has now acknowledged that the U.S. must participate in research on problems of global import. Three years ago one would be hard pressed to find in the U.S. science budget any substantial amount of money for research on issues of global import. This year the President's request for such research amounts to half a billion dollars and requires the participation of seven science related Federal agencies. In that interagency collaboration we again see the theme of sciences being brought together by the government to address a common problem.

Normally Federal agencies develop their budgets and initiatives internally then present them to the Office of Management and Budget for review and modification. The Global Change Initiative is different. The Office of Management and Budget

served as the coordinator and organizer of the Global Change Initiative budget rather than as its judge. That is a significant change from business as usual, and it indicates the special place that is being given to promoting the participation of U.S. scientists in the addressing of research issues of multinational interest.

You will no doubt agree that I haven't told you a thing about the two themes of your meeting, namely rickettsial disease vectors and organizational psychology and the older worker. I hope what I have done is to paint in the background against which international collaboration in such research will be taking place. You are fortunate to be exploring these opportunities at a time when U.S. policy makers have begun to turn away from an isolationist attitude that had slowed U.S. research collaboration with other countries for nearly fifteen years. At the same time, you are fortunate to be cultivating this cooperative endeavor as U.S. science itself is becoming a more intentionally collaborative and problem focused endeavor than it has been in decades. Because of these changes in our national science policy and in our practice of science, there is every reason for Israel and our other international partners in research to believe the U.S. is entering a time when it will be not only a willing partner but an able one as well.