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The Precarious Balance Between Research Openness and Security

Amid increasing competition and conflict with countries such as China, calls to restrict international scientific cooperation overlook benefits to the United States.

The United States is in the middle of a debate on the appropriate balance between openness and security for scientific research and development—a balance that has shifted significantly since the end of the Cold War. The COVID-19 pandemic, competition between the United States and China, the Russian invasion of Ukraine, increasing deglobalization, fraying supply chains, and current economic stresses have dramatically increased US political leaders' concerns with international scientific and technological collaboration.

This shift has bridged deep political divides to create a growing consensus among elected officials. The CHIPS and Science Act, approved by large majorities in the House and Senate in August 2022, along with new regulations from the Biden administration in October 2022, not only advance the US semiconductor industry but also limit China's ability to acquire certain advanced chips and manufacturing technologies. In January 2023, a bipartisan vote in the House of Representatives approved the creation of the Select Committee on the Strategic Competition Between the United States and the Chinese Communist Party to investigate issues such as the origin of SARS-CoV-2 and to recommend policy changes. In addition, a number of high-profile initiatives—with names like *Protecting US Technological Advantage* from the National Academies of Sciences, Engineering, and Medicine, or the "Task Force on Balancing Openness and Security Access Across the Department of Defense Academic Research Enterprise" of the Defense Science Board—have been examining how to protect US science, technology, and innovation given the challenge from China. All these and more could reset how openness and security are emphasized across America's science and technology enterprise.

Among the limits being considered are controls on whom US scientists can partner internationally with, what research can be openly published, and whether there should be additional restrictions on unclassified research—all of which would mark a distinct break with the policies of the last 40 years for fundamental basic research, regardless of whether that research is pure discovery or use-inspired. Before making such changes, a deep consideration of how that strategy of openness has benefited the country and propelled US preeminence in science, technology, and innovation is in order.

After World War II, American scientists were eager for increased international engagement to advance their country's science. The US government supported this partly as a way of understanding what scientists in other countries were doing and partly because US leaders saw science cooperation as a way to influence other governments and societies. Over the years, a doctrine of openness has evolved in the way the United States conducts basic research and engages in international research collaborations, including very large projects. Reducing this openness may have significant costs. The US scientific community will be less likely to learn what is being discovered by leading researchers in other countries, and restricting basic research relevant to security threats increases the possibility of the US government being surprised by developments with potential security risks. More broadly, limitations and restrictions aimed at foreign collaborations will slow the advance of science here.

From "ping-pong diplomacy" to "science diplomacy"

Relations between the United States and China improved from the era of "ping-pong diplomacy" in the early 1970s through Nixon's visit in 1972, but were not renormalized until the Carter presidency, with normal diplomatic relations resuming on January 1, 1979. Less than a month later, the Agreement Between the United States and China on Cooperation in Science and Technology was signed. That agreement, which formalized the exchange of scientists and students and scientific and technological collaboration, led to the creation of the Committee on Scholarly Communication with the People's Republic of China (CSCPRC), jointly founded by the American Council of Learned Societies, the Social Science Research Council, and the National Academy of Sciences (NAS), and administered by the NAS. The NAS opened an office in Beijing to facilitate scientific cooperation between the two countries. Scientific collaboration was seen as a low-risk way to strengthen their relationship. Thus, "science diplomacy" was an early and ongoing element of normalized relations.

My opinions on science diplomacy have been shaped by four decades of involvement in this scientific collaboration at many levels. In 1991, I took a sabbatical from the University of Tennessee to head the NAS international office in Washington, DC, overseeing and implementing the work of its committees such as the CSCPRC, the Committee on Japan, the Committee on International Security and Arms Control, the Committee on Human Rights, and the Board on Science and Technology for International Development. From 1994 to 2011, I was executive officer of the NAS and the National Research Council with responsibility for helping to oversee expert studies of the National Academies, which included those dealing with science and national security.

During these years, I made a number of trips to China to enhance cooperation and facilitate studies carried out jointly by the US National Academies and the Chinese Academies of Sciences and Engineering. The purpose of those studies was to advise our two governments on important issues requiring scientific expertise. Developing a strong relationship with members of the Chinese scientific community was seen as possibly helpful for increasing their ability to advise and influence the Chinese government as well as to advance science worldwide and develop solutions to some of the key challenges facing the world.

From 2011 to 2014, I served in the US government as science and technology adviser to the secretary of state; in that capacity, I engaged with US science and security agencies and with governmental and nongovernmental science officials and communities in other countries. The first international visit I made in this position was at the request of the Air Force Office of Scientific Research to join its team in meeting with South African scientists and institutions to explore potential collaborations in unclassified basic research with that office's funding. I became a fan of the approach taken by the basic research agencies in the Department of Defense (DOD) that recognized the importance of supporting open research domestically and internationally in areas that might become relevant for defense. Modest investments in international science have provided DOD with a window into the best science and scientists around the world.

Science diplomacy's special roles

Science diplomacy sometimes suffers from confusion about whether science is helping to advance diplomacy or diplomacy is helping to advance science. Science has proven at times to be a useful partner to help achieve diplomatic goals. One of the greatest successes was the Montreal Protocol on Substances that Deplete the Ozone Layer, finalized in 1987, which required the collaboration of scientists who raised concerns about the destruction of the ozone layer, corporations that developed refrigerants without ozone-destroying chlorofluorocarbons, and diplomats who pursued an international agreement. The same partnership helped advance the 2016 Kigali amendment to the protocol to reduce another class of harmful industrial gases, which the US Senate ratified in 2022. Similarly, the Intergovernmental Panel on Climate Change and its reports, including summaries negotiated between scientists and policymakers, have helped countries address the goals of the 2015 Paris climate agreement and contribute to international negotiations at the annual Conference of the Parties.

And, of course, diplomacy has also been useful for scientists—by, for example, reducing roadblocks that inhibit international scientific cooperation as has often occurred with visas and student exchanges. Scientists have returned the favor by demonstrating that personal relationships can facilitate progress on diplomatic issues. US and Soviet scientists who carried on informal, nongovernmental dialogues (often called Track II) in the 1980s contributed to advancing arms control of nuclear weapons in the 1990s. In the early 2000s, with the encouragement of both the US and Iranian governments, the two countries' science academies held joint workshops on issues including environmental protection, water conservation, earthquake protection, urban concerns, scientific ethics, and food safety. That collaboration continued for nearly 20 years, with several meetings held each year and frequent reports. Though the joint efforts didn't deal directly with nuclear issues, the good will generated between the countries helped enable governmental negotiations that led to the Iran nuclear agreement in 2015.

A precarious balance

In this era of competition and conflict, the balance between openness and security is precarious. In response to ethical lapses by scientists as well as legitimate security concerns such as patent infringement, inappropriate foreign talent programs, technology theft, and espionage, the United States and allied democracies are imposing new rules and restrictions on international scientific cooperation. So far, the scientific fields most affected are those in which China is investing heavily, such as artificial intelligence, synthetic biology, and quantum computing; all these emerging technologies have implications for national security and national defense.

Under the research security provisions of the 2022 CHIPS and Science Act and to respond to continuing government concerns, the National Science Foundation and other federal scientific organizations are charged with overseeing the improvement of security-related policies and training aimed at faculty, including disclosure of potential conflicts of interest or conflicts of commitment, and ensuring transparency of research funding sources

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All these science diplomacy initiatives have convinced me that international scientific engagement is vital to America's national interest. To be at the forefront of rapidly advancing scientific and technological change in this globally interconnected world, US scientists have to engage with the best scientists wherever they reside. Moreover, building the science, technology, and innovation capacity of other countries helps to advance knowledge-based societies worldwide, which is also in America's national interest. Science collaboration should be seen as an essential diplomatic asset for the United States.

Politics remains, however, a more powerful force than science. Science diplomacy initiatives can be overwhelmed in the near term. Relations between the US government and the governments of Russia, Iran, and Cuba are more fraught today than a decade ago. With the Russian invasion of Ukraine, it's likely to be a long time before international scientific collaboration between Western countries and Russia returns. Relations between the governments of the United States and China have become much more difficult and are getting worse. Still, current tensions should not obscure the fact that one way to influence countries is through their scientific communities.

such as those coming from foreign countries. The US scientific community has attempted to moderate some counterproductive elements of evolving federal policies and activities, including the FBI's arrest and Justice Department's prosecution of some Chinese-born scientists; those cases were ultimately dropped for lack of evidence. I believe the US government has constructively modified some of its dealings with individual scientists in response to dialogues with members of the scientific community.

Nevertheless, security concerns have left researchers unclear of what the rules are and facing increased roadblocks for international cooperation even in basic research. One effort to establish a new consensus regarding the rules is the National Academies study *Protecting US Technological Advantage*, published in September 2022. I am largely in agreement with the report's background chapters as well as a number of its findings, but the key recommendations leave many details up to the government through an ill-defined risk assessment process conducted by federal agencies.

For each defined threat, the report recommends using what it terms a "whole-of-government" interagency process for "developing an associated risk management strategy and

evaluation rubric for use by federal agencies in addressing the risk." My view of how to assess security-related risks of basic research is quite different. Assessing risks for each area of basic research potentially relevant for an emerging technology merits separate consideration. The only way to reach a workable, reliable, and timely risk assessment is through ongoing dialogue between top researchers in that field and representatives of the relevant government funding and security agencies.

In my view, the broad-strokes approach favored by this report will likely lead to overly conservative and prolonged risk assessments by agencies that will restrict basic research in important aspects. Such an approach will slow not only US scientific progress but the research needed to become aware of potential security risks. Especially concerning is the possibility of creating many more categories of "controlled but unclassified" research in areas with findings that were previously published in the open literature and are often conducted at universities where many of the leading researchers work.

research helped make the United States a magnet for talent from around the world.

Of course, there are other restriction mechanisms besides classification for some limited areas of fundamental research, including export controls and prohibitions on dual-use technologies under the International Traffic in Arms Regulations. These rules apply to research equipment as well as technical data that could have military or peaceful uses. Other examples include work categorized as Dual Use Research of Concern, such as research with dangerous pathogens, which requires review by the National Institutes of Health. It is clear, however, that potential risks of research related to a range of emerging technologies persist. For example, artificial intelligence developed to improve toxicity prediction for new drugs could be applied to developing new chemical warfare agents. Only with an ongoing dialogue between leading researchers and government agencies can some of these threats be anticipated and proactively addressed.

The January 2023 Meeting of Experts included representatives of research institutions—both universities and national laboratories—as well as federal research funders and government agencies dealing with national security, intelligence, and law enforcement. Although the meeting generated no conclusions, recommendations, or written report, it prompted a constructive dialogue that considered multiple perspectives as well as potential paths forward. Participants agreed on the need for engagement with the scientific communities and governments of democratic allies who are also trying to balance openness and security in basic research relevant to emerging technologies. Yet, in my view, the dialogue did not produce a route forward that avoids problems with the approach recommended in the *Protecting US Technological Advantage* report.

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A parallel effort to explore concerns regarding science and security occurred in January 2023 when the National Academies held a Meeting of Experts to discuss modifying National Security Decision Directive 189 (NSDD-189), which now operates as the "gold standard" for openness in basic research. This directive, issued in 1985, has remained in place over successive presidential administrations. It originated in the Reagan administration's response to a 1982 National Academies study known as the Corson report, named for the chair of its study panel. That report examined the need for controls on scientific information, technology, or knowhow that might reach the Soviet Union through open scientific communication. The key sentence in NSDD-189 states: "It is the policy of this administration that, to the maximum extent possible, the products of fundamental research remain unrestricted."

According to NSDD-189, when national security requires control over information generated from federally funded fundamental research, the appropriate mechanism is to classify that research. Thus, overall, the directive has a bias toward openness for government-funded work that has encouraged international cooperation for several generations. I believe this open environment in academic

A third effort could be very helpful in forging an understanding of the issues that underlie international engagement. In October 2020, the National Academies created a National Science, Technology, and Security Roundtable to provide a neutral venue where individuals from the national intelligence and law enforcement communities could meet with representatives from industry and the academic research community to discuss threats, opportunities, and potential risks. This consultation is intended to bring common understanding to the benefits and risks of openness and ideally will support informed decisionmaking.

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Looking to the future

Already, the heightened emphasis on security has meant that fewer Chinese students are coming to the United States for education. Further, I have heard from scientists in both countries who are now nervous about engaging in scientific cooperation with each other. Before the pandemic, China was the leading country for jointly authored publications with US scientists, but those numbers are now falling. Scientific cooperation between the United States and China in this new era is likely to be less robust than it has been in recent decades. And there is the possibility that the US-China science and technology agreement may not be continued.

As I have argued, the loss of basic research partnerships with China and other countries could have significant costs—to US universities that attract Chinese and other foreign students, to researchers doing collaborative work, and to the progress of global science. This trend comes at a time when research on shared concerns is sorely needed. International scientific engagement is essential for advancing science everywhere and solving the very global challenges that create geopolitical tensions—and so scientific leaders should work to maintain engagement with the world. Climate change, for example, has emerged as a national security threat for both the United States and other countries. And if the world is to make progress on technological and regulatory approaches to mitigating climate change, the United States and China need to cooperate in finding them.

In my view, one possible remedy is more in-person dialogue between the leaders of science in these two countries. Dialogues can be carried out by scientific academies such as the National Academies, professional societies such as the American Physical Society (APS), and umbrella scientific organizations like the American Association for the Advancement of Science. In the past, the National Academies and APS have done so and are now planning to do more. At in-person meetings, scientists can engage with each other to understand new rules for international scientific collaboration, including possible modifications resulting from national security concerns. In addition, these groups can discuss scientific integrity and the ethical standards required to advance science.

Joint meetings and dialogues will be helpful to prepare both American and Chinese scientists to discuss research collaboration with their own governments. Scientific leaders may need to explain to officials where certain rules and restrictions have gone too far and become counterproductive. Similarly, they may wish to explain to each other and their government leaders how past behaviors that were counter to the highest standards of science are detrimental to both scientific and diplomatic progress.

I believe no modifications are needed to the wording of NSDD-189. The US scientific community should push back against unclear and unnecessary changes to government risk assessment that would produce overly conservative restrictions. The US government needs to appropriate funding for the scientific research authorized in the CHIPS and Science Act as well as to encourage international scientific cooperation, including expanding cooperation with its democratic allies. Maintaining the openness that has served the United States well and made it a magnet for talent will require the US scientific community to take an active role in continuing to support open collaborations.

Further restrictions on research should be determined through ongoing dialogue and partnership among leading scientific experts, government funders, and security professionals. Such a process is far preferable to a generic requirement for agencies to develop a risk assessment approach likely to be poorly defined and laborious to implement. Failure to create clear and productive boundaries will ultimately discourage scientists from working in areas of basic research that are most critical for dealing with security concerns, including those associated with future pandemics and climate change.

With today's geopolitical turmoil, the United States is struggling to find and fix areas of weakness in the security requirements of its research system. But this is also a time to stop to fully consider the benefits that open collaboration in basic research have brought to the country's prosperity and security, as well as to spreading the values of openness, accountability, objectivity, fairness, and integrity that are fundamental to the scientific enterprise. There needs to be a deeper discussion of whether, by hurrying to address security concerns in a haphazard fashion, we may be shooting ourselves in the foot. I see no need to fundamentally change a strategy that has benefited our country so greatly.

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