Chapter 2

Biological Security in the Policy Landscape

Any attempts to understand the use of STH expertise in biological security policy must take place against the background of broader issues in science policy and politics. The "gulf of mutual incomprehension" between intellectuals trained in the humanities and the sciences, lamented by C. P. Snow as the lack of shared vocabulary among those who make decisions on technology policy and those who understand the underlying technologies, has changed little in the last forty years.[1] Individual leaders in the executive and legislative branches have placed varying degrees of value on S&T policy advice as part of the political decision-making process, both reflecting and exacerbating occasional tensions between the political, science policy, and science communities.[2]

As noted in 1988 by the Carnegie Commission on Science, Technology, and Government, "(s)cience and technology, effectively mobilized, can help the President achieve his Administration's goals. That mobilization can best be accomplished by bringing science and technology (S&T) into the highest levels of government."[3] Although all presidents since Truman have maintained some form of structured science advisory capacity, the influence and status of S&T advisors have depended upon each administration's distinct priorities. The President's Science Advisory Committee (PSAC), led by the Special Assistant to the President for Science and Technology, grew from demands for high-level technical advice during the Eisenhower presidency following the launch of Sputnik.[4] For its first few years, the committee thrived as a politically neutral liaison between the White House and the technical community, although its influence began to wane by the end of the Kennedy administration. President

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[1] C. P. Snow, *The Two Cultures*, (Cambridge, U.K.: Cambridge University Press, 1998 ed. [first published 1959]).

[2] The relationship between the current administration and the broad scientific community has appeared strained at times. Recent allegations that regulatory agencies have manipulated reports to remove or de-emphasize politically unpalatable data, and the replacements of appointees to federal technical advisory committees with experts who appear to have more politically sympathetic views, have drawn outcries not only from partisan opponents but an unusually public statement on "Restoring Scientific Integrity in Policymaking" whose signatories include 48 Nobel laureates. The statement, list of signatories, and a companion report by the Union of Concerned Scientists can be found at http://www.ucsusa.org/global_environment/rsi/index.cfm. The equally vehement rebuttal by OSTP Director John H. Marburger III on "Scientific Integrity in the Bush Administration," (2 April 2004) can be found at http://www.ostp.gov/html/ucs/ResponsetoCongressonUCSDocumentApril2004.pdf (accessed August 2004).

[3] *Science and Technology and the President* (New York: Carnegie Commission on Science, Technology, and Government, 1988), available at http://www.carnegie.org/sub/pubs/ccstfrep.htm (accessed August 2004).

[4] Bruce A. Bimber, *The Politics of Expertise in Congress: The Rise and Fall of the Office of Technology Assessment* (Albany, New York: State University of New York Press, 1996), 18-20.

Nixon, already at odds with the university research community over its opposition to his Vietnam policies, grew increasingly frustrated with what he perceived as PSAC's insufficient political loyalty, marked by its members' objections to administration priorities such as anti-ballistic missile defense and supersonic transport. He eliminated the committee and the special assistant's office in 1973, allowing the director of the National Science Foundation to fill the role of science advisor when necesssary.[5,6]

President Ford began restoring science policy advisory offices and structures upon taking office, and these have continued to evolve during subsequent administrations. The Office of Science and Technology Policy (OSTP), statutorily created in 1976 to advise the president on S&T issues,[7] succeeded the individual science advisors who served Presidents Truman and Eisenhower, the Office of Science and Technology initiated by Eisenhower and eliminated by President Nixon, and the successor program established by President Ford. During the George H.W. Bush and Clinton administrations, the Director of OSTP also held the title of Assistant to the President for Science and Technology, a special status not granted to the current OSTP director.[8] The current organizational structure for S&T advice to the White House includes the President's Committee of Advisors on Science and Technology (PCAST), a group of outside experts who issue reports and recommendations on a range of S&T issues, and the National Science and Technology Council (NSTC), a Cabinet-level council chaired by the president, started in 1993 to coordinate S&T policy development and implementation across all Federal agencies.

The Office of Technology Assessment (OTA), the former internal S&T advisory organization to the US Congress, also met a grim fate. Congress launched OTA in 1972 to fill the need for nonpartisan, unbiased S&T policy analyses on the range of increasingly complex technical issues facing legislators, derived from a source independent of the executive branch.[9] A strictly bipartisan Technology Assessment Board comprised of members of Congress reviewed OTA reports to ensure lack of bias and oversaw the staff of about 200 OTA analysts, most of whom held advanced degrees in a scientific discipline.[10] As described by a roundtable participant who served within OTA, the organization existed to provide Congress with policy analysis on issues where a basic understanding of the underlying science and

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[5] Ibid.

[6] The National Science Board, "A History in Highlights: 1950-2000," accessible at http://www.nsf.gov/nsb/documents/2000/nsb00215/nsb50/1970/supp_dir.html (accessed August 2004).

[7] National Science and Technology Policy, Organization, and Priorities Act of 1976, Public Law 94-282 (11 May 1976).

[8] Brendan A. Maher, "John H. Marburger III: Science Advisor to the President," *The Scientist* No. 16(4) (18 February 2002), 60.

[9] The Technology Assessment Act of 1972, Public Law 92-484 (13 October 1972).

[10] Ted Agres. "Informing Congress: A Return of the OTA?" *The Scientist* No. 15[19] (1 October 2001), 8.

technology contributed dramatically to understanding the implications of policy decisions. OTA staff conducted the analyses and wrote reports, with the assistance of advisory panels of "technical and substantive experts," in response to bipartisan requests from Congressional committees. OTA conducted fairly long-term studies, rather than answering quick technical questions about scientific facts (the purview of CRS), although the staff could provide studies ranging from broad assessments that might take a year or more to shorter-term projects, such as workshops on specific topics. Technical memos and background papers contained factual material, while assessments presented policy options, rather than recommendations.

> They were always on controversial areas – Congress doesn't care about things that don't come to its attention – and they typically got wider interest because the communities that really cared about those areas would both be working with us as we did the study, and they'd be usually waiting to see it as it came out.…In many ways, I think we wrote for the public constituency, because that's one way to get the message back to Congress.[11]

After 23 years and hundreds of comprehensive reports spanning the life sciences, environmental and energy issues, transportation technologies, and military and security analyses, the 104th Congress voted to withdraw funding. OTA closed in September 1995, a victim largely of budget politics.[12] Efforts to revive OTA in the recent years through legislation have not succeeded despite support from the science policy community.

What do these ups and downs in formal science advisory bodies portend for providing STH expertise in the national biological security policy process? Roundtable participants, especially those in the session that drew heavily from the "professional" science advisory community, discussed extensively how these legacies and the current science policy climate affect decision-makers' openness and access to science policy advice. Although both PSAC and later OTA enjoyed high levels of credibility among technical experts and receptive policymakers, their well-merited reputations for offering politically neutral and competent S&T advice did not prove sufficient to save them during times of budget, organizational, and political turmoil. The executive branch in particular, with its more uniform set of political objectives, may be less open to influence by outside S&T advice that appears insensitive toward an administration's goals, or by a science community viewed as openly partisan. Although it would be an exaggeration to say that levels of trust between the current administration and academic researchers have disintegrated to those of the early 1970's, several participants pointed out that recent heated exchanges

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[11] Roundtable discussion, Session 1.

[12] Bruce Bimber, *The Politics of Expertise in Congress.* Following the "Republication Revolution" of 1994, the Republican Conference passed a resolution on Congressional reform that included cutting legislative branch budgets; abolishing OTA's relatively small $20 million budget offered symbolic savings with little short-term impact on legislators' constituent interests and services.

between groups of scientists or science advocates and the administration played out in the media,[13],[14] do affect the climate for S&T policy advice, particularly the receptivity of executive branch decision-makers to analyses that might be critical. While the scientists themselves may distinguish between objectively derived technical advice and their own political views and opinions, policymakers may not make such a clean distinction between the views of *science* and individual *scientists*.

Second, the demise of OTA left a vacuum that can be detected not only in uneven access to S&T analysis among members of Congress, but in the changing demands on remaining governmental and non-governmental policy analysis organizations. The role of non-governmental organizations (NGOs) that provide S&T advice, defined by the Carnegie Commission as the universe of institutions ranging "from broad-spectrum general-purpose scientific and technical groups, such as the American Association for the Advancement of Science, to elite academies, such as the National Academy of Sciences and its affiliated National Research Council, from there to an extensive array of discipline-specific societies, such as the American Physical Society, through think tanks dedicated to government work, such as the RAND Corporation, and on to policy advocacy groups," [15] continues to grow. The National Academies have taken on more of the burden for long-term studies. Legislators and their staffs who might have once turned to OTA for S&T policy or technical questions can depend on the remaining two Congressional analytical support agencies.[16] In addition, they also depend increasingly on S&T experts within the NGO community, who may have different backgrounds, different sources of information, and possibly different organizational stakes in various issues. Participants pointed out that these consulting relationships between Congressional staff and S&T policy analysts arise from no particular standard institutions; affiliations may grow from past working relationships, meetings at seminars or other formal S&T policy events, word of mouth, or informal professional/social networking.

The population of professionals who are "bilingual" in the vocabularies of research culture and government policy continues to evolve as well. Although no census has captured the numbers of technically trained scientists and engineers with advanced degrees working in government and policy analysis past and present, the variety of fellowship opportunities and academic programs aimed

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[13] Rick Weiss, "Science Not Being Distorted, White House Aide Says," *Washington Post* (3 April 2004).

[14] Geoff Brumfiel, "US Science Policy: Mission Impossible?" *Nature* No. 428 (18 March 2004), 250.

[15] *Facing Toward Governments: Nongovernmental Organizations and Scientific and Technical Advice* (New York: Carnegie Commission on Science, Technology, and Government, January 1993), available at http://www.carnegie.org/sub/pubs/ccstfrep.htm (accessed August 2004).

[16] Ted Agres, "Informing Congress."

specifically at cultivating such individuals has increased dramatically in the last twenty years.[17] The American Association for the Advancement of Science (AAAS) S&T Fellowship programs (described below) alone now counts about 1700 alumnae, with larger classes of fellows entering the program each year. Approximately one-third of each year's AAAS fellowship class elects to remain within the policymaking and policy analysis communities. This pool of "fellow fellows," jokingly referred to by some roundtable participants as the "Policy Mafia," has created an informal but robust network for the exchange of information and expertise. In addition to the AAAS programs, a number of new fellowship programs for technically trained professionals sponsored by technical societies, academic institutions, and foundations have been established in the past decade. Participants agreed that the presence of these fellows, former fellows, and other scientists seeking what are often labeled "alternative careers" in policy have changed the baseline level of technical sophistication in the policymaking and policy analysis communities, and not just in the executive branch agencies with R&D missions.

> …Going back to the fifties, the first Presidential Science Advisory Committee, the scientists were in a wasteland. There was nobody in town who had any clue about that, so those individuals who did were extremely powerful because they were the only ones who knew anything. Certainly by the seventies, certainly today, my impression is you really can't make that case any more….It's a little bit institutionalized. There are a lot of people with technical degrees.[18]

Former science and technology fellows sponsored by AAAS and other programs who return to academia may also help enhance the image of science policy as a desirable science career. Despite increased training opportunities and obvious interest, roundtable participants cautioned that scientists willing to leave the laboratory bench for policy work still remain the exception rather than the norm, and many of the academic researchers overseeing graduate and post-graduate education still regard such "alternative career" choices somewhat dubiously. Many participants with technical backgrounds in biology had experienced tacit or explicit disapproval from leaders in their academic institutions at expressing an interest to work in any government capacity other than within a national laboratory. Although scientists can test the waters with a short fellowship without permanently "leaving the bench," or participate in policymaking through short-term commitments to technical studies such as those carried

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[17] Even partial lists of such science and technology policy fellowships show an enormous range of opportunities for scientists, engineers, and physicians at various career stages. A list of fellowships administered by the National Academies can be found at http://www.nationalacademies.org/grantprograms.html and the AAAS S&T Fellowship descriptions can be viewed at http://fellowships.aaas.org/. Several academic institutions offer one-year fellowships, and the impact of the Homeland Security Fellowship program will be seen in upcoming years. The MacArthur Foundation's Science, Technology, and Security Initiative seeks specifically to create science and security analysts (http://www.macfdn.org/issues/issue_1/story_1.htm). (All websites accessed August 2004).

[18] Roundtable discussion, Session 1.

out by the National Academies or standing advisory boards, most who stay in the policy community for more than a year find themselves too far out of the academic life cycle – or perceived as such by more traditional academic researchers – to return to the laboratory. Most participants agreed from personal experience that they had few regrets about "leaving the fold," as many termed the process of electing a science policy career over a science research career, as they had discovered during graduate training or post-graduate research that their interests encompassed more than science. However, the lack of professional rewards for public service in even more limited capacities worried many participants. Although, for example, the National Academies regularly recruit very distinguished scientists for study committees, such service does take scientists away from the laboratory and writing, with little or no professional recognition. Although a relatively minor burden for tenured or otherwise senior researchers, the lack of career incentives may discourage researchers earlier in their careers from volunteering to serve as technical experts. As giants who have offered decades of public service to infectious diseases and biological security research and policy (participants specifically mentioned Drs. Joshua Lederberg, Philip Russell, and D.A. Henderson) approach retirement, roundtable participants worried about who might take their places.

Participants in all sessions agreed that the generally low level of science literacy in the US presents a serious problem in communicating science and technology issues to policymakers and the public. The discussions touched on the ongoing need to improve science education at the primary and secondary education levels. Several participants pointed out that the traditional science training "pyramid," designed to weed out an increasing number of students at each level of education, contributes little to cross-disciplinary scientific understanding. As one participant mentioned, leaders in the legal field seeking science advice frequently joke that they became lawyers specifically because they did not understand science – a problem shaped by didactic methods rather than intellectual ability. Due to the vast number of existing reports and editorials on the subject of scientific literacy and science education, the roundtable discussions referred to the issues repeatedly but did not explore them in depth.

WHAT DOES STH EXPERTISE LOOK LIKE?

In order to proceed with a discussion on the adequacy or deficiency of certain types of STH expertise in the biological security process, one must first define them. In the course of the discussions, participants identified several forms that scientific expertise can take; all fulfill the general task of providing an interface between the scientific community and decision-makers. These currently accepted forms for providing STH expertise in the national biological security policy process strongly influence when and how science policy information can be supplied, particularly for agencies or bodies that rely

strongly or exclusively on particular mechanisms. Definitions below are based on descriptions offered during roundtable sessions unless noted otherwise.

Standing advisory bodies to Congress

With the demise of OTA, the other two standing bodies that provide in-house analytical expertise to Congress have taken on an increasing number of technology-based studies. The Government Accountability Office (GAO, formerly the General Accounting Office) and the Congressional Research Service (CRS) offer different resources to members of Congress and their staffs. GAO carries out investigations at the request of members of Congress, evaluating how well federal programs meet their objectives and use funds, or issuing legal opinions on programs. GAO's reports are generally reviewed by the federal programs involved to allow comment; they are published for Congress, but made available to the public. GAO reports on S&T issues generally address processes (such as budgets or compliance with statutes) rather than technical matters. CRS responds to a large number of short-term direct requests from Congressional staff, including technical questions, but its analysts can also produce longer studies by request or in anticipation of requests (based on staff judgments). In recent years, CRS has made a concerted effort to hire senior analysts with S&T expertise, especially in the area of homeland security, and has established a small (8-person) technology assessment staff. CRS studies undergo internal review only, and are published as in-house documents exclusively for the use of Congress.

Standing advisory bodies to security and regulatory agencies

In addition to presidential advisory bodies such as PCAST, which formed its own subcommittee on S&T to combat terrorism in 2002, several standing federal advisory committees provide S&T expertise on security issues to Executive branch agencies. The most well-established of these, the Defense Advisory Board, provides S&T advice on issues of military importance to the Secretary of Defense. Board members chosen for relevant S&T expertise serve on internal task forces (with outside consultants added when necessary) to address specific technical or science policy questions, and subsequently submit reports outlining their recommendations, some of which can be accessed by the public.[19] Although the Board largely considers military technologies, recent task forces have focused on force health protection against biological weapons as well the SARS epidemic. The Army, Navy, and Air Force maintain their own similarly structured science boards as well. In February 2003, the FBI launched its Science and Technology Advisory Board, modeled upon the Defense Science Board, to report to the Director on S&T applications and strategies for FBI priorities, including preventing terrorist attacks. Independent S&T

[19] Previously published reports can be found at http://www.acq.osd.mil/dsb/reports.htm (accessed August 2004).

planning advice offered by the new Homeland Security Science and Technology Advisory Committee will be directed to the Under Secretary for Science and Technology of the Department of Homeland Security (DHS). The intelligence community maintains standing committees of experts to provide insight into emerging S&T, economic, and defense topics. Standing advisory boards provide two major advantages: the abilities to mix "new" experts with those more versed in the policy environment through staggered rotations, and to build trust with decision-makers.

Issue-specific or ad hoc advisory bodies to security and regulatory agencies

Many agencies make use of advisory bodies of technical experts convened regularly or on an ad-hoc basis to consider specific technical areas rather than general S&T issues. These may be statutorily required by Congress, such as the Secretary's Council on Public Health Preparedness at the Department of Health and Human Services (HHS), or convened by the agencies themselves to gather information on a specific topic quickly. For example, the FBI has created an advisory group on microbial forensics to provide technical advice on building a more robust national capacity for tracking biological weapons to their source through molecular signatures.[20] Such advisory groups can provide input ranging from assessment of technical arcana to evaluating long-term policy strategies, allowing agencies to compensate quickly for a lack of internal expertise in this field or reassuring Congress and the public about policy objectivity. These structures also provide an avenue for allowing S&T experts from academia or industry to participate directly in providing science policy advice to federal decision-makers.

Such limited-subject committees may also include groups of S&T experts convened by the intelligence, defense, and security communities to brainstorm or "red-team" technology scenarios. Some projects to bring together changing multi-disciplinary teams of technical experts in various research fields in order to approach security questions from a fresh perspective have endured for more than a decade. Public access to information about committee membership and meetings varies; the intelligence community approaches some S&T experts through consulting mechanisms that include public disclosure, while others disclose neither member participation nor the project descriptions in official publications.

Professional societies

Professional societies, representing those who share specific technical training or working areas, have become a growing source of information on biodefense and biosecurity issues in the past three years. Speakers from societies representing public health workers and laboratories, health care providers and

[20] Bruce Budowle et al., "Building microbial forensics as a response to bioterrorism," *Science* No. 301 (26 September 2003), 1852.

hospitals, and state and local health officials have testified frequently before Congress about readiness for potential biological attacks. Professional societies representing biological and biomedical researchers have provided technical information and science policy advice on biological security measures, as well as a larger forum for engaging the researchers most directly engaged in biodefense research. These organizations bring their members into contact with policymakers, allowing them to share their technical expertise as well as their views of the "real-world" environment affected by government decisions, with an understandable commitment to advocacy on behalf of their members in addition to S&T advice.

Non-profit, non-governmental policy organizations

In the last decade, many defense and security policy analysis organizations have cultivated increased technical expertise in biological security issues.[21] Some groups that once concentrated primarily on weapons proliferation issues have added biodefense and biosecurity to their portfolios; others, such as the UPMC Center for Biosecurity, were founded to address emerging biological threats and countermeasures specifically. All of these organizations produce reports and host meetings, symposia, or workshops, providing expertise to decision-makers through publications, briefings, and testimony, as well as through personal relationships with policymakers and their staffs (what the Carnegie Commission called "individuals as vectors" in its 1993 report on NGOs[22]). Participants in the first and third roundtable discussions acknowledged the impact of major funding organizations on the analyses conducted by policy organizations, with foundations' strategic areas of focus and funding decisions driving the direction of collective grant-making and subsequent studies.

The range of non-profit, non-governmental organizations offering independent technical and policy analysis includes federally funded research and development centers (FFRDCs). FFRDCs conduct studies by direct contract to regulatory or security agencies. The Department of Defense (DOD) employs several non-profit FFRDCs to conduct S&T studies, as does each service branch. Defense FFRDCs such as the Institute for Defense Analysis retain experts in a range of S&T disciplines, with areas of focus that include biological security. (DOD also contracts for scientific studies with for-profit FFRDCs operated

[21] An illustrative but non-comprehensive list includes the Council on Foreign Relations, the Center for Strategic and International Studies, the Carnegie Endowment for International Peace, the Stimson Center, the Center for Nonproliferation Studies at the Monterey Institute for International Studies, the Nuclear Threat Initiative (NTI), the Chemical and Biological Arms Control Institute, the Center for Arms Control and Non-Proliferation, and the Federation of American Scientists.

[22] *Facing Toward Governments*, 1993.

by corporations and consulting groups such as JASON.) In April 2004, DHS established its first FFRDC, the Homeland Security Institute, at ANSER.[23]

AAAS, which serves more than 10 million direct or affiliated members and produces the journal *Science* for an estimated readership of about one million, fills a policy role as the largest general science membership organization. AAAS influences S&T policy in the legislative and executive branches through position statements, policy programs and national meetings, briefings and conferences for policymakers, and its annual policy yearbook and R&D budget analysis. Its analyses tend to focus on issues of interest to the scientific community in general, and include substantial work on the impact of post-9/11 security measures on research and researchers. As foreshadowed by a 1993 Carnegie Commission report,[24] AAAS has reached out to the judicial branch with a program that helps federal judges locate qualified scientists to serve as court-appointed independent technical experts. Recently, AAAS launched the MacArthur Foundation-supported Center for Science, Technology and Security Policy, intended to serve as a clearinghouse to connect policymakers to sources of technical expertise on national security issues, particularly science and security experts from the MacArthur Initiative Centers.[25] AAAS also exerts an immediate impact on policymakers through its Science and Technology Policy Fellowship program.

Fellowship programs

Fellowship programs provide one established method of introducing technical expertise directly into Congressional or Executive agency offices, simultaneously providing fellows with hands-on public policy experiences and government offices with resident scientists. The AAAS Science and Technology Fellowship program began in 1973, at about the same time as OTA, with seven Congressional fellows. The program spans the academic year, rather than a Congressional session, in order to allow faculty to participate during sabbaticals. Fellows are chosen through a rigorous selection process intended to screen for a solid technical background and the analytical and communications skills critical to success in a policy environment. Over the last 30 years, AAAS expanded its program to act as an umbrella organization for fellows sponsored by other scientific and engineering societies, and to begin fellowship programs for the Department of State, the US Agency for International Development (USAID), the Department of Defense (DOD), the Environmental Protection Agency, the National Institutes of Health,

[23] A press release from the Department of Homeland Security (April 2004) can be found at http://www.dhs.gov/dhspublic/display?theme=27&content=3535 (accessed August 2004)

[24] *Facing Toward Governments, 1993.*

[25] Information on AAAS membership, programs, publications, and the Center for Science, Technology and Security Policy can be located through http://www.aaas.org (accessed August 2004).

the National Science Foundation, the US Department of Agriculture (USDA), the Food and Drug Administration, and other federal offices. The most recently added AAAS science and technology fellowships include two Homeland Security Fellows to be placed within the DHS Directorate for Science and Technology, and an NTI/Global Security Fellow who can work in Congress or the Executive branch but must focus on biological threats. The demand for fellows has increased in the past few years, from 95-100 fellows annually in the past to more than 115 in 2004; the number of Defense fellows alone climbed from 2-3 per year to more than ten.

Science and technology fellowship opportunities at the State Department have also expanded beyond the AAAS Diplomacy Fellows program. The American Institute of Physics (AIP) and the Institute of Electrical and Electronics Engineers now sponsor fellows under the Professional Science and Engineering Society Fellows Program. (The first AIP Fellow, George Atkinson, became the second Science and Technology Advisor to the Secretary of State.) The Carnegie Corporation and MacArthur Foundations, in partnership with the State Department, have started the pilot Jefferson Science Fellows program, selecting five tenured faculty members from academic institutions for a one-year fellowship followed by a five-year period in which the fellows will remain available to the department as consultants.[26] Unlike the AAAS fellowships, which are open to scientists at any post-graduate career stage and frequently offer a career-changing experience, the Jefferson program aims specifically to recruit mid-career scientists who plan to return to their academic institutions.

The degree to which offices successfully integrate individual fellows into the decision-making process depends to a large degree not only on hierarchical structure, but whether the office has enough in-house STH expertise or repeated experiences with S&T fellows to make the best use of their skill sets. The effect of such science fellowships on the policy environment goes beyond the immediate impact of each fellow's projects, although many have played key roles in fashioning pieces of significant legislation, or developing and implementing agency policies. If the trend of approximately one-third of AAAS fellows electing careers as science policy professionals continues to hold, the number of science-policy "bilingual" experts available to provide STH expertise to the government will obviously grow.

The National Academies

The four organizations that compose the National Academies, chartered during the presidency of Abraham Lincoln to advise the government on science and technology issues, continue to carry out that

[26] Technical information on Jefferson Science Fellowships can be found at http://www7.nationalacademies.org/fellowships/Jefferson_Science_Fellows.html (accessed August 2004).

mission today at a much greater scope. The National Research Council (NRC) serves as the working arm for the National Academy of Sciences and the National Academy of Engineering, and with the Institute of Medicine coordinates the logistics of bringing together about 1000 study committees composed of around 10,000 volunteer technical specialists each year.[27] In addition to carrying out studies, the National Academies also convene workshops, administer fellowship programs, and conduct educational outreach.

About 80% of National Academies study requests come from federal agencies, many by statutory requirement, and receive support through contracts and grants. The remainder includes self-funded studies as well as those conducted with the support of private foundations, industry, or state governments. Examples of such studies include the self-funded investigation into potential roles for S&T in countering terrorism initiated after the terrorist events of fall 2001,[28] and the privately funded "Fink Report" on dual-use biotechnologies. [29] The latter, supported by the Sloan Foundation and NTI and initiated before the anthrax assaults, became an eagerly awaited template for federal decision-makers considering oversight regimes for inherently dual-use biological research.

The NRC process begins with the review and approval of study requests. After the project has been defined and approved, the assigned NRC project staff sets about recruiting unpaid subject matter experts to sit on a study committee capable of addressing the issues. National Academies studies generally draw the nation's pre-eminent scientists and technology experts. After the committee meets and considers the project, sometimes soliciting additional insights from stakeholders, its members develop consensus on the content of the final report. An external NRC committee reviews this document to verify that the committee remained within its charge, and to ensure that the results appear free of bias and conflict. The National Academies remain the nation's premier source of independent S&T analyses, and the Academies' experience with classified information and national security issues dates to World War II. Currently, every major unit of the National Academies is conducting at least one project related to biological security or defense.

All roundtable discussants expressed great familiarity with National Academies studies, many as "consumers" using such studies in advising senior policy makers during decision-making processes, and some as both users and NRC study committee veterans. All agreed on the critical role that NRC studies play in government decision-making; some expressed frustration with the amount of time and resources

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[27] Information on the history and organization of the National Academies can be found at http://www.nationalacademies.org/about/faq.html (accessed August 2004).

[28] *Making the Nation Safer,* 2002.

[29] *Biotechnology Research in an Age of Terrorism,* 2003.

necessary to produce an NRC report, due to the format and the review process, and a few with purely academic experts on study committees who lack deep familiarity with the relevant policy environment. Finally, some cautioned that, while the National Academies policy requiring all reports to present consensus views ensures that decision-makers do not have to weigh warring S&T advice on a single issue, the need to eliminate dissension can lead to rather conservatively drawn conclusions. As remarked by one participant, "if you want a National Academy study you have the gold standard imprimatur of neutral science experts who can say it is truly non-partisan, politically neutral. But the problem is, there you do have to achieve consensus."

Science advisors and in-house expertise

The ranks of science advisors and in-house experts include both those with official titles designating them as such, and technically trained professionals within Congressional offices and regulatory or security agencies whose roles includes providing S&T policy advice as part of a more complex job description. The latter may be employed as the "lone scientist" in an office or program and fill the role of informal science advisor to decision-makers on a range of S&T issues, or may serve in an environment rich with other technically trained professionals. Examples of the "lone scientist" include the growing numbers of science-trained professionals working in Congressional offices as staff, or the scientist who heads a research or analytical program for an agency focused mostly on operational missions in security or law enforcement. Agencies rich with in-house S&T expertise include those with a strong research and development mission, such as HHS with its resources in the CDC and the National Institutes of Health, DHS with its Science and Technology Directorate, or even the Central Intelligence Agency (CIA) with its S&T development programs. Merely having in-house expertise does not guarantee that such resources will be brought into the policymaking process. As a participant with decades of experience as the "lone scientist," pointed out, many decision-makers in the law enforcement and the intelligence communities think immediately of turning to S&T experts to provide useful new gadgets and technical analysis, but reminding them that scientists can also inform the policy process at other levels requires constant outreach.

The most visible new example of a high-level, active science advisor comes from the Department of State. A 1999 NRC study on the increasingly important role of science and technology in foreign policy, funded by the Carnegie Corporation of New York and the Golden Family Foundation, emphasized the need for senior leadership within the State Department to keep STH issues appropriately on the

decision-making agenda and to develop core STH competencies throughout the department.[30] Following one of the study's recommendations, and with statutory authority conferred by Congress, former Secretary of State Madeleine Albright appointed Dr. Norman Neureiter to serve as the first Science and Technology Advisor to the Secretary of State (STAS) in 2000. As noted above, he was succeeded at the conclusion of this three-year term by Dr. George Atkinson. The STAS under Secretary Colin Powell continues to lead a department-wide initiative – based substantially upon other recommendations in the NRC study – to reinvigorate science in the State Department. Despite a relatively small staff, the two advisors so far have embarked upon an outreach program to other agencies with S&T expertise, increased the number of science and technology fellows from all programs working at State (about 40 in 2003, distributed among 18 offices), increased the number of scientist detailees from other government agencies at both State and US embassies, and pursued a few bilateral initiatives designed to build S&T cooperation.[31] However, as with in-house expertise, merely having a science advisor is not enough to guarantee incorporation of STH expertise into the decision-making process. Support from the highest administrative levels in the department must exist to grant the science advisor adequate authority, access to departmental leadership, and resources.

[30] Committee on Science, Technology, and Health Aspects of the Foreign Policy Agenda of the United States, *The Pervasive Role of Science,Technology, and Health in Foreign Policy: Imperatives for the Department of State*, (Washington, DC: National Academies Press, 1999), 27-29.

[31] Norman P. Neureiter, "Science and technology in the Department of State," *Technology in Society* No. 26 (2004), 303.