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## SCIENCE AND ITS DISCONTENTS An Evolutionary Tale

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American Association for the Advancement of Science

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### ABSTRACT

This paper analyzes the roots and implications of conflict between the conduct of science and government predilections in the United States, including the security state and neoconservative control of Washington. Three major conflicts are discussed: the emergence of new security and secrecy regimes that seek control of science; religiously derived moral viewpoints that seek to limit scientific research; and the purposeful shaping and censoring of scientific findings for political gain. All three policy issues, argues the author, have their roots in a growing public mistrust of science and its purposes, but also the actions of the current presidential administration. What is needed, he states, is a set of rules rooted in several common understandings or rules. First, policies resting on scientific or technological issues, like all public policies, are decided in the end not just by experts but by a variety of people and interests. Second, objective scientific results, tested by repeated efforts at confirmation, are necessary (though not sufficient) elements in such policy decisions. Third, if the scientists responsible for those findings are controlled or silenced by particular policy interests, or committed in advance to any particular category of policy outcome, the resulting decisions are likely to be wrong. If adopted in advance of the installation of the next administration, or at the outset, such a set of rules could be seen a forward-looking improvement in governance, rather than as yet another criticism of what has been going on in this one.

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This paper explores some of the more difficult relationships science, especially that practiced in the universities, has with the rest of society. To introduce them briefly, one of these involves pervasive differences of view between those who practice science and those who attempt to preserve national security by keeping secrets. Another is relatively newer: it is a challenge to some firm scientific understandings we have about the nature of the evolutionary process and Earth's geological history -- a challenge arising with increasing intensity from evangelical religious groups and the special educational institutions they create. Still another is a relatively new political problem -- a tendency for government policy-makers to adjust scientific findings, even those of their own agency employees, to make them fit with some predetermined policy objective. These three problems, I want to argue, have roots in a growing public mistrust of science and its purposes.

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### **The Nature of the Science-Security Conflict**

Let me begin with the first of these. It has to do with an old and persistent struggle between the need of science for the free exchange of information, data, and materials on the one hand, and the need for governments to claim, often in the national interest, restrictions on that freedom. This perennial contest between science and security is often amplified by the rather different personal qualities, experiences, and backgrounds of those who practice the two professions that occupy the two ends of this bipolar seesaw. There is always a risk that characterizing these traits will lapse from modal description into caricature, but I think most observers will recognize the cultural differences I'm going to sketch.

Most scientists, especially those who have chosen to work in academic settings, have backgrounds that have emphasized personal scholarly commitments, skills of the kind required to design experiments and interpret their results. For them, the emphasis has been on individual accomplishment and not on the capacity to form working groups in which teamwork is an important value. Those who are security professionals have had different educational experiences in which the latter qualities receive more emphasis. They tend to be more comfortable with hierarchy, and to develop common goals the achievement of which requires a high degree of agreement – a common culture developed through the exercise of particular social skills. In common parlance, these two cultures are often given cartoon names: the scientists are the nerds, the security folks are the spooks.

It is small wonder, therefore, that when contests arise that pits the needs of science and those of security against one another, misunderstanding and tension often result. In California we have witnessed a long debate over the University of California's management of the national laboratories at Los Alamos and Livermore. These preceded the public furor over the case of Wen Ho Li at Los Alamos, but were sharpened and intensified in its aftermath – and reached a crescendo of sorts in the run-up to the decision to bid the weapons lab contract competitively. You may recall the strength of some of the public statements made by participants in the debate; they exemplified the points of view represented by the different interests in its outcome.

Contests between science and security were also underway during the early years of the Reagan administration. Faculty members at Stanford were telling me of problems they were having with scientific foreign visitors – either in the process of getting them admitted in the first place, or having to endure monitoring requirements if those efforts succeeded. The basic problem, we quickly discovered, was that the International Traffic in Arms and Arms Export Control regulations – intended for potential military hardware and specifications – were being applied to basic research data. As a result, foreign nationals were sometimes barred from participating in scientific symposia; others were not permitted to work on projects in academic laboratories; still other visitors had to be followed around by their faculty hosts if they visited other laboratories in the area.

Academic institutions and their faculties objected strongly to what they saw as a misapplication of the arms control statutes; in 1982, when the issue was intensely controversial and yet unresolved and I had to beg to get on Science's editorial page, I wrote: "If a Soviet scientist is viewed with such alarm that universities must be asked to police his visit, then the Department of State can apply visa controls. And if a technology has such military value that exposure in an open environment presents clear risks to national security, the government can classify the technology – thereby permitting the universities to decide in advance whether than can accept the restrictions that come along with the work. But to apply a burdensome set of regulations to a venture that has gained such great strength through its openness will cost the nation more than it can be worth."

Attempts to resolve the problem were undertaken by a group called the DOD-Universities Forum, which I co-chaired with Richard DeLauer, the Undersecretary of Defense for Research and Education. The

Department of Defense side was mostly inclined to be cooperative, but DeLauer had to contend with an internal struggle against the Assistant Secretary for Policy, Richard Perle. Eventually a National Academy of Science committee chaired by Dale Corson, the physicist who had been President of Cornell, recommended eliminating the use of such regulations as proxies for classification.

A deafening Federal silence followed both the recommendations of the Forum and of the Corson committee, but eventually – when no one I knew was expecting anything – President Reagan issued an executive order establishing National Security Defense Directive NSDD 189. It said, in pertinent part, “It is the policy of this Administration that, to the maximum extent possible, the products of fundamental research remain unrestricted. It is also the policy of this Administration that, where the national security requires control, the mechanism for control of information generated during federally funded fundamental research in science, technology and engineering at colleges, universities and laboratories is classification. Each federal government agency is responsible for: a) determining whether classification is appropriate prior to the award of a research grant, contract, or cooperative agreement and, if so, controlling the research results through standard classification procedures; b) periodically reviewing all research grants, contracts or cooperative agreements for potential classification. No restriction may be placed upon the conduct or reporting of federally funded fundamental research that has not received national security classification, except as provided in applicable U.S. Statutes.”

This history is touched on thoughtfully in last year’s Kerr lectures by Chuck Vest, President emeritus of MIT and now President of the National Academy of Engineering. He knows it well, because he was an active and very useful participant on the university’s side in this long struggle – along with was MIT’s man in Washington, Jack Crowley. Jack and the Association of American Universities were consistent allies who did a great deal to support the openness of university science in a difficult time.

Fast forward to today: National Security Defense Directive 189 is still in effect, confirmed first by a letter from National Security Agency Director Condoleezza Rice in a 2002 letter. It won’t surprise you that the recipient was then-President Charles Vest of MIT, who must have asked exactly the right question at the right time. NSDD 189 is thus the Administration’s policy; it exempts fundamental research from attempts at secrecy that fall short of classification. That policy, however, has repeatedly been honored in the breach by the present Administration. Indeed, there is now an official, or at least quasi-official acronym for such a proxy. It is “SBU” and it stands for “Sensitive But Unclassified” -- a category that at the same time exists but does not.

Concerned with this Renaissance of faux classification, the universities have responded by examining the terms of government contracts more carefully. The Association of American Universities and the Council on Government Relations had polled its member research universities to inquire about whether contract or grant arrangements they made had limits on publication or other restrictions that, in violation of NSDD 189, had involved the use of classification proxies. The largest number of these involved publication restrictions, and the next largest limitations on participation of foreign nationals. The 16 institutions reported problems with 180 submissions; of these 40 were accepted anyhow, 60 were renegotiated by the institution, 15 were declined, and 23 were unresolved through negotiation at the time the report was completed in 2004. What became clear from the analysis is that federal agencies operating at contract-officer level, or perhaps above, were applying criteria that clearly contradicted national policy.

Concern in the academic community was intensified by another application of the arms export control regulations to basic science research projects – the responsibility, in this case, belongs to the Department of Commerce under the Export Administration Regulations. Under its terms, certain kinds of information or services critical to national security cannot be sent abroad to unlicensed persons or nations. But if the transfer to such a person or entity is undertaken domestically, it is called a “deemed” export (that’s your government saying “well, it’s just like an export so we’re calling it one”).

The university research community did not feel particularly threatening about all this until a 2004 report emerged from the Inspector General of the Department, entitled: "Deemed Export Controls May Not Stop the Transfer of Sensitive Technology to Foreign Nationals in the U.S." That brought forth, in addition to a lot of academic angst, a series of negotiations conducted under Commerce's Bureau of Industry and Security. Academic representatives were able to have some useful discussions with the Assistant Secretary in charge of that bureau, and eventually the findings contained in the Inspector General's report were discarded.

Meanwhile, some strange circumstances emerged because part of this responsibility rests with the Department of the Treasury's Office of Foreign Assets Control (OFAC). It shares with Commerce the list of nations, institutions and people who are on the "don't license" list. It turns out that countries like Cuba and Iran are on that list, which tells you what you need to know about it. Under an OFAC ruling, if a paper came in as a submission to Science – say from a group doing ecology in Cuban forests – the natural thing for me to do with it, if it looked like good science, would be to edit it. But it turns out that giving that service to an unlicensed entity, if given in the United States, would constitute one of those "deemed exports." I was terribly tempted to publish a brief paper allegedly from Iran full of the most egregious errors of construction and spelling, with a note above it saying that OFAC would let me print this as is, but would punish me for editing it. Fortunately, OFAC came to its senses before I could do anything that foolish.

### Scientific Publication and Security Issues

In fact my role as a journal editor brought out a whole set of quite different contests between science and security. After 9/11 it came to be recognized that some reports we publish might provide information or techniques useful to evil-doers. Conferences were held at the National Academy, with some thoughtful help from the Center for Security and International Studies. At one large meeting there, there was a mixture of scientists, a few journal editors, and some security people. There was a little tension in the room, but polite discourse dominated the scene. There was a collective intake of breath, I think, when one of the CSIS attendees said, to one of the microbiologists: "Well, it might make you a little uncomfortable if one of your reprints turned up in and Afghanistan cave with a lot of yellow highlighting."

An Academies committee chaired by Gerry Fink of MIT was meanwhile completing work on analyzing the threat potential presented by already published papers. The committee's conclusion, having examined several cases that were thought to raise possible security questions, was that none of them presented serious risks. It was plain to everyone that the public needed some reassurance that the security issue was being taken seriously by scientists and by the editors of scientific journals. After the main session held at the Academies, a group of scientist authors and editors met for a day to discuss the matter. In the end it was decided to craft a statement suggesting that there were reasons to be alert to security concerns, that journals should have processes for evaluating submitted papers that would be sensitive to possible public health benefits as well as possible liabilities in the security area. The editors of Science, Nature and PNAS agreed on a document that was eventually published as an editorial in all three journals.

But there are possible problems at both ends of the spectrum. Some microbiologists argue that knowledge will always yield more benefits than risks, and that any "regulation" at the journal level will be counter-productive. But new advances in "synthetic biology" -- brought closer by the promise that novel genomes derived from planned oligonucleotide sequences may soon be able to create novel pathogens -- is likely to turn the issue into one of somewhat deeper public concern. So I think that in the domain of scientific publication, the struggle between science and security is unlikely to disappear anything soon.

I also believe, however, that in the vast majority of cases such conflicts ought to be resolved in favor of science and of open communication. The cases carefully examined in which material published in a scientific journal might have led to lapses in national security, the conclusion has been that the benefits of

disclosure (for example, the benefits to public health of developing the genome sequence of a new pathogen) would exceed any likely costs resulting from possible utilization by the nation's enemies.

### **Confidence in Science and Scientists**

Quite beyond the issues raised by the science-security conflict, it is often believed that public confidence in science has diminished sharply. There is a case to be made here, but before we take it too far it is a good idea to look at what polls say about the public regard for other professions. Scientists and professors are still among the most trusted professions – more, for example, than journalists, politicians, business leaders, and clergymen. So perhaps the situation is not as bad as the temporal shifts would suggest.

If public confidence in science and its practitioners is diminishing, even if not relatively, the phenomenon nevertheless asks for an explanation. I would note several possible explanations of fairly recent origin. First, the growth of science into a prominent role in the regulation of food and drugs, consumer products, the workplace and environmental quality has created controversies that readily draw public attention. To many, regulation is an easily-resented dimension of government control over individual behavior; and increasingly, scientific findings are cited as its justification. Then controversy often arises, as industry scientists and scientific experts hired plaintiff's lawyers present the scientific findings in radically different ways. The public often doesn't know what or whom believe, or what to make of this -- save that some of these experts must be lying or simply wrong on the facts. Finally, scientist advocates for more regulation, particularly in the interest of environmental protection, sometimes do so by citing worst-case scenarios that may open the advocate to the charge that he or she is just trying to scare people.

### **Religious Challenges**

But another source is the recent escalation of conflict between science and religion. In the United States, an increase in the number of citizens committed to evangelical forms of Christianity has created a new fissure in the public regard for science. In many Christian schools, the science curricula entail the use of texts that do not teach about evolution, and offer scriptural arguments to support setting the age of the Earth at 6000-10,000 years. It is not simply a matter of offering an alternative system of belief. These texts, which I have examined carefully in preparing to be an expert witness in a court proceeding in which the University of California is a defendant, offer claims against the validity of data gathered to support the evidence for radiocarbon dating or the evolutionary process.

Students who have families and cultures that value scripture as a system of belief will get a clear message from these representations: Science is a source for troublesome and easily falsified conclusions. It should not be a surprise if these students are unlikely to support scientific findings, arguments, or policies. This problem is worsened as the conflict between science and religion escalates through strong anti-religious statements on the part of high-profile scientists like Richard Dawkins. It is beginning to look as though the two belief systems are creating distinct social cultures that cannot find a domain of political or intellectual agreement.

That has had important consequences for national science policy, and of course for how science is practiced in the nation's universities. Research on the biology of embryonic stem cells is surely the most important and contentious of these issues. In August of 2001, President Bush declared that embryonic stem cells could not be used by investigators supported by federal funds except for cell lines that were already in existence, having been cultured from surplus embryos slated for discard following in vitro fertilization procedures. The number of the preexisting lines and their quality has been matters of debate: at first there were said to be 72, but many had contamination or were regarded by investigators as unpromising. The final number appears to be a dozen or so, some of questionable quality.

Researchers want more, but the President's Executive Order forbids the future use of federal funds to support investigations of stem cells derived from embryos, even those scheduled for destruction. It is argued that this position is based on a kind of ethical universal, but that appears to be an overstatement of convenience. The belief that life begins at conception is hardly a universal belief, even among religions. The objections to embryonic stem cell research rest on the belief that a single cultured blastocyst is living in the sense that it can develop into a functioning, living human organism. But of course it cannot do that unless it is implanted in a living, healthy human uterus. That is why a generation of embryologists, many with high ethical standards, have never called a blastocyst an embryo; the term has been restricted to post-implantation development in which the rearrangement and sorting-out of tissues has begun.

The Presidential Executive Order in the stem cell matter is actually an interesting case in the misuse of science. By attributing human-ness to an entity that has only the most distant probability of gaining life without further human intervention, it makes science appear to support a policy that has been decided beforehand, on the basis of a particular set of religious convictions. Of course, this problem may have been set aside through the recent finding, published I'm glad to say in *Science*, that reprogrammed human epithelial cells can apparently fulfill the roles of embryonic stem cells.

### **Science Abuse in the Bush Administration**

This is not the only case in which the policy cart has been put before the science horse in the Bush administration. It should be no surprise that this is common practice, because the President has signaled his disinterest in serious science and scientific opinion from the very beginning. One major science appointment in the administration after another has been delayed, or given to a candidate with few qualifications save political loyalty, or given to a scientist with little or no access to the President or his cabinet officers.

It strikes me as quite probable that the treatment of scientists and science by the Bush administration over the past 7 years has been the result of a mistrust of science and its practitioners. Early in his first campaign, Bush expressed contempt for members of the "intellectual elite" he knew as a Yale undergraduate. Other senior members of the administration have expressed similar views. The offices in the Old Executive Office building – part of the White House complex – once housed Dr. Allan Bromley, the Science Adviser to George H. W. Bush. Dr. John Marburger, who holds that position for his son, has been evicted, or one should say rusticated, to another quarter.

I have followed the continuation of that pattern as we tracked down further episodes in the News columns of *Science*. Early incidents involved political loyalty tests for early appointees to scientific positions. Advisory Committees (at FDA, OSHA, and other agencies) were eliminated and then reconstituted with memberships more closely associated with Administration positions. A new FDA adviser was a doctor who said he recommended prayer to cure post-partum depression. And so it went.

Many have pointed out that past Administrations had made politically friendly science appointments. That is doubtless true. But the scale of what's happening now dwarfs what we've seen in the past. And the problem is not just about positions. Rather, it is the appearance of a new and troubling relationship between science and security, one in which security is imposed not to protect the public from the possibility that science might fall into hostile hands, but to protect the public from knowing science that might run against a government policy.

There are so many cases of this that I will only focus on a few – the most serious of which have involved the management of scientific expression by scientists who are themselves employed by the government. The issues around climate change have been especially tempting candidates for imposed controls by an administration reluctant to adopt economically expensive mitigation strategies. For some time Jim Hanson,

a leading climatologist from NASA, was subjected to limitations as to where he could speak, or requirements for pre-screening the speeches; fortunately, Hanson is a determined man and would have none of that, so the world is now hearing from him scientifically. Others lack his capacity for embarrassing his handlers into doing the right thing: members of a delegation sent by the administration to an international conference on climate were instructed not to use the phrase “climate change” but to substitute “climate variability.” This language manipulation may persuade listeners that what’s happening is due to inevitable aspects of Earth’s physical history, rather than that there’s a new vector for which we may have some responsibility.

One of the important duties of federal biologists in the Fish and Wildlife Service (FWS) of the Department of the Interior is to make designations of the loss of habitat critical to threatened or endangered species, thereby providing evidence for the appropriateness of the listing. After reports by anonymous FWS employees and an article in the Washington Post, the Inspector General of the Department conducted a thorough investigation. It reports that McDonald, by background an engineer, repeated edited reports of the biologists, exchanged scientific information with outside groups, and harassed and bullied FWS employees. The Inspector General referred the case for possible prosecution on the grounds that McDonald had shared government information with private sources, including industry lobbyists. After having been scheduled to appear before a Congressional hearing, she resigned her position.

The Union of Concerned Scientists, an organization founded at MIT in the 1960’s by Henry Kendall and others, has expanded its own activities dramatically during the Bush years. Having earlier focused on nuclear weaponry and nonproliferation, it now concentrates on areas in which the Bush administration has coerced scientists or manipulated the facts to encourage policy outcomes that it favors. Hearings conducted by Congressman Waxman during the past year have provided an opportunity for UCS to present testimony derived from its own investigations. Science has published frequent News summaries of these findings.

An interesting specimen case occurred recently when Dr. Julie Gerberding, head of the Centers for Disease Control and Prevention, was asked to present Congressional testimony on the potential impacts of climate change on public health. White House folks reviewed her prepared testimony, as is the usual practice. At the end of that process, virtually all of what she said about climate change – six pages of it – was blacked out. But there’s an odd little story about this: Marburger’s office raised a few questions about particular statements and made suggestions; but then the Office of Management and Budget, apparently unwilling to go to work on the suggestions, simply eliminated everything in question.

Should science always win conflicts with security? Surely no one would suggest that. But one could hope that the case for security would be based on realistic threats. Now, alas, security’s triumphs owe too much to the administration’s desire to shield information from the public that might otherwise cast doubt on its policies. This state of affairs is not merely an over enthusiasm based on national security, as was often the case in the 1980’s. It is simply an abuse of science.

### **A Path for a New Presidential Administration**

What could be done? Some will say that because a new administration will enter at the beginning of 2009, these problems will likely diminish or possibly even disappear. But even if that happens, it will be a temporary fix. What is needed is a set of rules rooted in several common understandings. First, policies resting on scientific or technological issues, like all public policies, are decided in the end not just by experts on those issues but by a variety of people and interests. Second, objective scientific results, tested by repeated efforts at confirmation, are necessary (though not sufficient) elements in such policy decisions. Third, if the scientists responsible for those findings are controlled or silenced by particular policy interests, or committed in advance to any particular category of policy outcome, the resulting decisions are likely to be wrong.



The rules needed to support wise policy-making on these matters should include at least the following. The a newly-elected federal administration will necessarily include positions whose occupants will be chosen in part by their sensitivity to the new President's policies as well as their expertise in the domain of their special function. A list of such appointees would include Cabinet Secretaries, some Assistant Secretaries, and Commissioners or Administrators of science agencies – in addition to senior appointees in the Executive Office complex. Perhaps the President's Science Adviser – the Director of the Office of Science and Technology Policy – could be required to list and justify these positions at the beginning of each new Administration. Government scientists in all other positions, and those non-government scientists appointed to advise agencies of the government, should be selected on the basis of scientific excellence and a proven record of expertise within the scope of their assignments. Appointees and advisers in this category would be protected against any tests of political loyalty in advance of appointment, from appointment criteria based on advance commitment to particular policy outcomes, and from any efforts on the part of senior Administration officials to censor or manipulate their scientific conclusions or recommendations.

If adopted in advance of the installation of the next administration, such a set of rules could be seen a forward-looking improvement in governance, rather than as yet another criticism of what has been going on in this one.