Forbidden Knowledge and Censorship in Science

Running head: Forbidden Knowledge

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"One fatal Tree there stands of Knowledge call'd, Forbidden them to taste."

-- John Milton, *Paradise Lost*

From *Genesis* to Milton, and from Faust to Frankenstein, the lesson emerges that there are some truths that we should not know. In contemporary science, as in literature and myth, some knowledge is so intimate, so fundamental to who we think we are that its exposure risks undermining the foundations of our culture (*1-5*). Determining which knowledge ought to be forbidden can often be contentious, as recent debates in *Science* attest (*6-8*). *How* decisions to control science are made is as important as determining *what* knowledge is deemed dangerous.

The most visible controls on science are made via explicit, formal regulation. Examples include current legal restrictions on human cloning or use of fetal tissues and embryos, and longstanding constraints on nuclear and other weapons-related technologies. Formal controls have grown in response to increasingly sophisticated and potent scientific knowledge (*5*). Increased regulatory requirements, such as those governing work on biohazardous materials, have purportedly discouraged some scientists from pursuing controversial research (*9*). Less explicit limitations also arise, as demonstrated recently by Congressional watchdogs and religious activists concerned about government-funded research on sexual practices and other socially sensitive topics *(10-13)*. As critical sponsors of science and technology development, industry constrains science, particularly its dissemination, treating commercially valuable – as well as potentially damaging – science as trade secrets (*14-16*).

Scientists also attempt to control research, as symbolized by the 1975 Asilomar moratorium on recombinant DNA (*5*). The scientific community recently developed policies regarding the dissemination of potentially dangerous knowledge, following a public outcry over *Science*'s publication of a paper disclosing the synthesis of poliovirus (*6-8,17*). Because the

scientific community lacks the self-governance typical of a profession such as medicine or law, these formal controls are rare, hard to enforce, and generally occur only in response to perceived threats of external regulation (*18*).

There are no empirical data on forbidden knowledge in science. To begin to fill this gap, we performed this interview study to examine why and in what ways scientists constrain and censor their work.

In late 2002 and early 2003, we conducted 10 pilot and 41 in-depth semi-structured interviews with a sample of researchers drawn from prestigious US academic departments of neuroscience, sociology, molecular and cellular biology, genetics, industrial psychology, drug and alcohol abuse, and computer science. We chose diverse disciplines to gauge the range, rather than the prevalence, of experiences with the suppression of knowledge. In-depth interviewing allowed us to cope with the empirical challenge of studying that which does not occur.

At the end of each interview, we asked 4 attitudinal questions about scientific freedom and social and professional constraints. In general, our respondents perceived science as responsible and "safe," and scientists as "moral." Many expressed the belief that knowledge is, in and of itself, a worthy pursuit. As one respondent stated, "truth and knowledge is always the most liberating thing, even though it's often unpleasant and not what people want to hear."

As shown in the Table, most respondents agreed that scientists have an obligation to discover and report the truth, even if the results are controversial. Several respondents referred to Rind's meta-analysis of long-term effects of childhood sexual abuse (19) and Herrnstein and Murray's analysis of race and intelligence (*20*), asserting that, even though the conclusions and interpretations were inflammatory, these publications enabled critique. But respondents

uniformly acknowledged that there are legitimate constraints on what and how science is pursued. There was agreement that editors act as gatekeepers for ethical practices. There was, however, less agreement about specific constraints on science, particularly those that appear to be politically motivated, or, as one respondent characterized it, are "just typical of American yahoo politics."

We asked subjects to consider their own practices and rationales for limiting scientific inquiry or dissemination, and to tell us about cases of restrained science experienced by them or their colleagues or known in their discipline. Respondents reported a wide range of sensitive topics, including studies relating to human cloning, embryonic stem cells, weapons, race, intelligence, sexual behaviors, and addiction, as well as concerns about using humans and animals in research.

As anticipated, our respondents reported cases of formal, explicit restrictions on research. However, the majority reported constraints that we have here classified as informal, even *ad hoc* restrictions, and personal self-restraints.

Formal constraints

The most wide-ranging constraints on scientific inquiry are regulations and guidelines codified by governmental agencies, legislative bodies, universities, professional societies or journals, and institutional review boards (IRBs). About half (46%) of the respondents reported specific examples of formal restraints, ranging from outright moratoria (e.g., human cloning) to severe restrictions (e.g., stem cell research) to procedural hurdles (e.g., IRB review).

Respondents generally agreed that formal restrictions yielded valuable protections to society, research subjects and their own liability. Less consensus surrounded the necessity, efficiency, or good sense of specific policies. Stem cell research stood out as an example of

overly restrictive limits. As one respondent argued: "legislators aren't necessarily the wisest people to make decisions about what is good research." Although such skepticism was not voiced widely, many respondents expressed a preference that science police itself, that scientists – not policy-makers – should determine which research is too dangerous to be conducted and published.

Informal constraints

While many scientific boundaries are imposed by official regulatory bodies, the majority of restraints reported by our respondents occur informally. We characterized informal restraints as limitations that are imposed on the researcher (rather than self-directed), but are not codified or written. For instance, there may be an unspoken rule that everyone in a field "knows." As one respondent stated, "every microbiologist knows not to make a more virulent pathogen." (Notably, this "rule" did not prevent scientists making a more virulent form of mousepox (*17,21*) or experiments using the coat proteins from the 1918 pandemic flu virus (*22*)). Sometimes researchers only know that they have encountered forbidden knowledge when their research breeches an unspoken rule or is identified by legislators, news agencies, activist groups, IRBs, peer reviewers or colleagues as somehow problematic. Milgram's obedience studies (23) and Humphreys's study of anonymous sex in a public bathroom (*24*) were severely criticized only after publication.

Most respondents (66%) had personally experienced informal restraints or knew of cases in their discipline. Many (42%) described how their own work had been targeted for rebuke. More often, researchers (49%) reported stories about colleagues whose careers suffered because their work breeched unwritten norms. Researchers told us these "cautionary tales" to explain why they chose to forgo potentially sensitive research. In 6 cases, however, the lure of

controversial topics seduced researchers, usually in the hope that it would promote their careers or further a particular agenda.

Scientific boundaries: More than a third (39%) of the respondents reported that they or their colleagues chose not to pursue or publish research because some aspect of the study contravened their discipline's accepted dogmas. These boundaries were sometimes severely enforced. One respondent reported the tale of a young statistician who lost his job for co-authoring a controversial paper about race and intelligence. Sociologists, in particular, avoided inquiries that might suggest a biological basis for inequality (e.g., race and genetics), largely because such arguments are "politically retrograde" or "too hot to handle." Several researchers also noted (as did Kuhn (25)) that dominant paradigms in their academic disciplines limit inquiry by rendering some ideas natural and others unthinkable.

Activist groups: Researchers across disciplines reported that activist groups had tried to intervene or halt their research. One sociologist attracted the attention of advocates when he published an article that undermined their central claim. In response, the group allegedly sent an anonymous letter to his institution asserting funding improprieties. An AIDS researcher was accused by activists of engaging in "murderous behavior" because, by running an anonymous survey, he could not report HIV+ research subjects who practiced unsafe sex. Six subjects raised concerns about animal rights activists. Several expressed fear of what one described as "terrorist" threats. One respondent even refused to talk to the interviewer (JK) until she proved her institutional affiliation. He explained "for all I know, you are somebody from an animal rights organization and you're trying to find out whatever you can before you come and storm the place."

Commercial interests: Three researchers reported that they or their colleagues sometimes limited the types of data collected and analyses conducted to appease corporate sponsors. A statistician (involved in drug and alcohol research) said that pharmaceutical companies commonly asked his colleagues to conduct subgroup analyses that demonstrated positive effects, while subverting the main analysis of the study. An industrial psychologist stopped a study on sexual harassment in the workplace because the company feared that suggestive study questions might persuade employees to sue.

Cultural constraints: Many respondents reported that they altered their research agendas to abide by cultural norms in the US. These restrictions affected nearly all those in drug, alcohol and HIV research, whose research findings often conflict with commonly held beliefs. An alcohol researcher lamented his perceived inability to conduct "controlled drinking" trials (where alcoholics are taught to drink in moderation) in a culture that believes alcoholics cannot drink. Several drug researchers said that they did not pursue studies that would give food vouchers to addicts who stayed clean because of the chance of moral outrage, as expressed by one respondent, "I mean, who's going to pay cocaine addicts to stay clean? Can you imagine that being on the front page of the [local paper]?" Similar concerns were voiced by an HIV researcher who veiled his focus on gay men when writing NIH grants to avoid provoking the interest of legislators. A few researchers reported concerns about losing governmental funding if they chose to study controversial topics.

Self-constraints

Finally, 16 (39%) respondents imposed constraints on their work for personal reasons whether ideological, ethical or professional. For example, researchers restricted their own research because of discomfort with particular methods, especially regarding the use of animals

in research. While these researchers acknowledged the value of and need for these experiments, they refused to get involved personally. "I do think that it's important to do research with higher model organisms, I personally made the choice to work with yeast and bacteria because it just was easier for me, less stressful," was a typical response from one microbiologist. In contrast, two respondents reported leaving Europe because animal research is less regulated in the U.S. Similarly, a few social scientists chose to work with less problematic populations, avoiding research on vulnerable subjects such as children and the poor.

A second set of self-imposed limits arose from fears about how research findings could be used. Despite recent increases in available bioterror funding, some scientists avoided pathogen and weapons research. One scientist said that he would not accept money from the Department of Defense for any project. Others chose not to publish research findings that they believed might increase the stigma of minority groups. While interested in studying subconscious sexual harassment, one psychologist avoids the topic because she "worried about... the impressions people would draw from that kind of research or the conclusions that they might draw... that they would either use to justify somehow sexual harassment or try to get... [persons] accused of harassment off from some kind of charge." Such fears were not unwarranted: one of our respondents discovered his work being used inappropriately to promote a political cause that he did not support.

In summary, we find that sensitive topics inspire formal and informal constraints that have a palpable effect on the production of science. Respondents reported cases in which research was done, data were collected and analyzed, but results were communicated in a selective way so their implications would not be transparent to outsiders, or with appropriate caveats aimed at preventing misinterpretation. In others, full results were simply not reported.

In several instances of nonpublication, the results were nevertheless discussed informally, rendering them unreliable and thus potentially more damaging. Most respondents tried to foresee the politicization and potential for misuse of their findings, and avoided the controversy that could result. Others relished in it.

We failed to detect a coherent ethos regarding the production of forbidden knowledge. Respondents at once decried external regulation, but recognized the right of society to place limits on what and how science is done; stated that scientists are "moral" and "responsible," but acknowledged cases in which scientists were sanctioned for performing studies and interpreting results outside the mainstream of their disciplines; and stated that information and "truth" had inherent utility, but admitted that full and open publication was not always possible. These idiosyncrasies ensure that some people will conduct and publish sensitive research, even as their colleagues avoid it. It also suggests that forbidden knowledge is a dynamic social category, its contents shift depending on the political environment and the interests of individual scientists.

Most importantly, we found that informal limitations on science are more prevalent and pervasive than formal constraints. While formal constraints will bias science – by affecting what is studied and how it is studied – these biases are relatively transparent and amenable to political change. Informal constraints, in contrast, may be culturally ingrained and resilient to change, may be beyond formal control, and may leave no markers by which to assess their effects. This study shows that forbidden knowledge is more than theory or anecdote. It is an everyday reality for working scientists that can and does affect what is studied, how studies are performed, how data are interpreted, and how results are disseminated.

Agree or disagree with the statement:	strongly disagree	disagree somewhat	neither agree nor disagree	agree somewhat	strongly agree
"Science and scientists have a responsibility to seek out and report the truth regardless of its ethical, legal, moral, and social implications."	1 (2)	4 (10)	8 (20)	11 (27)	17 (41)
"Society has the right to place limitations on what scientists study and how they perform their research."	5 (12)	10 (24)	3 (7)	14 (34)	9 (22)
"A journal editor should reject a paper if peer review concludes that the data was collected using unethical methods."	2 (5)	2 (5)	1 (2)	9 (22)	27 (66)
"A journal editor should reject a paper if peer review concludes that the results would undermine or clash with societal norms."	29 (71)	8 (20)	2 (5)	1 (2)	1 (2)

Responses to attitudinal questions regarding scientific freedom and constraints. Figures in parentheses are percentages.

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26 This study was approved by the University of Pennsylvania Institutional Review Board. We thank all respondents for their helpful participation, Brad Sitko for assistance, and Arthur Caplan and Charles Bosk for comments. This research was supported by the Greenwall Foundation (JK, CSP, JFM) and the Robert Wood Johnson Foundation (JK).

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Hi Jon: The database is fine now; Yolanda has gone to a better job and Brendan Nardozzi is my current assistant. I have just received the second review of the manuscript (both follow this message) and am going over the reviews myself.
Sincerely,
Barbara

Barbara R.Jasny, Ph.D.
Policy Forum Coordinator

Review 1
This is a great topic, and one that could really benefit from airing in Science. It covers the many reasons that science may be constrained, and ways that can be accomplished. Now for the "but." The title of the piece is "forbidden knowledge," with lead-in from a portentous Miltonian quote. This clearly frames the issue as "places science should not go because they are inherently dangerous." That is one small subclass of the many kinds of scientific constraints reviewed in the article. These include human cloning (which for some, like Kass, are indeed about places science should not go because it is repugnant; but for others [probably most] it is a matter of safety and efficacy, or governance, not "forbidden knowledge"), but other things like human research that imposes pain or risks, and bioweapons, which is not forbidden so much as unwise for utilitarian reasons. And the article also touches on industrial ties and conflicts of interest, where the overlap area of concern is usually about whether data should be published because they might harm a study sponsor, not because the knowledge is forbidden. And the issue of biohazard is introduced, although the concern there was safety--not whether knowledge was dangerous, but the way to get it was. At the least, the different constraints need to be laid out cleanly, up front, and distinguished, and the authors need to choose whether they are talking about forbidden knowledge, or about constraints on science that include but are not restricted to that category. Right now, the reader is lost without such a taxonomy.

The second problem of the piece is ambiguity about whether it is a report of new empirical data--the results of their interviews--or a policy forum posing the dilemmas about constraints on science. It could perhaps do both, but that would have to be clear up front. As it is, we don`t learn about any empirical work until page 3, and there is not methods or results section, but those are rather woven into the text. This subordinates the quotes and interview findings to the article`s structure: formal constraints, informal constraints, and self-restraint. Those headings need to be mapped to the goals of the constraints (whether to foreclose inquiry altogether because of danger or ethical concern [e.g., Milton`s and Kass`s concern and "the fall"], to prevent harm caused by research or its foreseeable application [e.g., biohazard, biowarfare, or bioterror], or to ensure ethical conduct of research without harming research participants [e.g., Nuremberg and IRBs]). Without that mooring, the text moves from example to example that seems different in type, and it becomes difficult to discern what to make of the examples, other than that there are many sources of constraint on science, and three general degrees of formality in addressing the concerns: formal regulation, informal regulation, and self-regulation (and there is considerable overlap between the latter two, and as noted many players outside science who influence both formal and informal oversight, although these other players are mainly noted in the discussion on "informal" constraints).

Main conclusions:
1. Important topic, well worth pursuing in the pages of Science,
2. A topic that needs clarity about both reason for constraint as well as how contraints operate,

which this paper does not do well, and
3. Authors need clarity about whether this article is to report new observations based on their interviews (in which case the voices of those interviews should frame the piece, with a less editorial front section) or it is a policy forum intended to generate discussion, in which case the interviews should probably be handled as a separate web document that can go through the sample, methods, findings, and conclusions.

Review 2
The topic of efforts to restrict scientific inquiry is an important one, but this paper does not merit publication.

First, the paper is poorly conceptualized. The authors do not explicitly define the categories „forbidden knowledge‰ or „censorship,‰ and little effort is made to note the importance of distinctions between several quite distinct reasons that people might decide to limit scientific inquiry. Their underspecified notions of forbidden knowledge and censorship seem to encompass:

1. Restrictions on the conduct of research for safety reasons (e.g., biological hazards that might endanger communities); this pertains to the risks of research practices, not the knowledge that research produces.
2. Restrictions on the conduct of research aimed at protecting research subjects (humans and/or animals) for ethical reasons; again this does not pertain to the knowledge produced but concerns the practices for producing it.
3. Restrictions aimed at preventing the production of knowledge that would challenge established orthodoxies, be they religious, cultural, scientific, political, etc.
4. Restrictions on the dissemination of knowledge that might be hazardous if placed in the wrong hands (e.g., knowledge relevant to weapons development).
5. Restrictions on knowledge that some believe would result in development of dangerous or unethical technologies; that is, technologies that according to some, no one should have.
6. Restrictions on the production and/or dissemination of knowledge for commercial reasons.

The authors do nothing to suggest that these rather different phenomena belong in the same category or that the arguably inflammatory terms „forbidden knowledge‰ and „censorship‰ are appropriately applied in all of these cases. In addition, the conceptualization of the paper appears to miss practices aimed at controlling science advisory committees, which have generated extensive debate in such areas as climate change, especially under the current administration. Military classification also deserves attention. Recent allegations of censorship by pharmaceutical firms might also be discussed.

The second problem with the paper is empirical. In-depth interviewing is a reasonable way to conduct a project of this type, but the results of these interviews are not presented in a compelling way. The percentages in the table are not especially meaningful in a sample of this type, and the fragmentary qualitative statements (e.g., about a „young statistician‰ who „lost his job‰ for a controversial paper are too abbreviated to be very meaningful; we don,t get any deep sense of what happened: who knows--maybe the paper contained indefensible statistical errors?). Given the lumping together of so many diverse controls on research under the „forbidden knowledge‰ rubric, it is not surprising that the results are hard to interpret.

The authors are correct to conclude that dynamic social processes shape ideas about what research should be restricted, for what reasons, by whom, using what processes. But this paper adds little (except for perhaps confusion stemming from the imprecision of the „forbidden knowledge‰ label) to the analysis of these processes.

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Hi Barbara,

Thanks again for forwarding the reviewers' comments. We've read the reviewers' comments very carefully, and offer the following response.

1. In our view, both reviewers were troubled by the same conceptual issue raised by our failure to clearly define "forbidden knowledge." We believe we can address this issue by providing a definition along the following lines:

Forbidden knowledge, as conceptualized in the philosophy of science literature, is very broad. Four major categories have been described. Consequentialist arguments claim that certain knowledge is too dangerous (Cohen 1977; Nelkin 1982; Shattuck 1996; Smith 1978). A second type of knowledge is forbidden because it can only be obtained through unacceptable means (Cohen 1977; Nelkin 1982; Smith 1978). A third category of forbidden knowledge is that which is prohibited by religious, moral, or secular authority (Cohen 1977; Shattuck 1996; Smith 1978). The final class of forbidden knowledge is fragile knowledge, which becomes tainted or destroyed in the process of coming to know it (Shattuck 1996; Smith 1978).

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These categories, while instructive, are not grounded in empirical data, nor do they explain the mechanisms by which knowledge is forbidden. We note that both reviewers recognized the many different sources of constraints on science, and this paragraph would provide for the reader the explicit definition the reviewers were looking for. Perhaps we should also foreshadow our dominant finding in order to clarify the organization of our results. That is, our results indicate that forbidden knowledge is a dynamic category, the contents of which shift depending on culture, political climate and the interests of researchers. Thus, it is more appropriate to define forbidden knowledge by mechanism of control, rather than the objective content of any given study. We could use this as a transition to our discussion of the study.

2. Regarding our use of data, we wrote the paper for a policy forum because we believe the issues raised here are extremely timely and address difficult science policy questions. We note too that, in some views, the topic of restrained science itself is highly evocative. We believe the use of empirical data here is justified to help think about forbidden knowledge and the constraints on science.

Our study is the first to examine how scientists understand and experience forbidden knowledge in their day-to-day work lives. Our methods are inductive; we chose to not impose an *a priori* definition of forbidden knowledge on the data. Instead, we allowed the concept of forbidden knowledge to emerge from scientists' stories.

We found that researchers do not experience forbidden knowledge as a clearly demarcated category. First, even explicitly forbidden knowledge is not "forbidden" in the Miltonian sense. No omniscient being will strike down the errant researcher (who may live in South Korea, unimpeded by such constraints). Second, the ambiguous status of forbidden knowledge is fostered by the multiple social controls imposed on scientific activity. What one researcher perceives as forbidden (e.g., studies on race and intelligence), another researcher pursues with relish. Third, researchers' interpretations of forbidden knowledge are informed by a relatively small number of highly publicized cases of controversial science. These findings are provocative, as they suggest that the mechanisms of social control of knowledge are diverse and occasionally capricious, making them difficult to assess and measure.

3. The 2nd reviewer criticizes our tabled opinion data as "not especially meaningful"; we aren't sure what this means, and we show in our text discussions that respondents' choices were consistent with expressed opinions about scientific freedom and social controls. In addition, the criticism of our description of a young statistician who purportedly lost his/her job misses the critical point that our respondent understood from this case that it was the subject matter of the analysis -- race and intelligence -- that was taboo and particularly risky for the scientist, not the methodologic skill of the statistican. We of course don't agree that our diverse controls have been "lumped together", since we have identified categories of control. We do think, in light of these comments, that we should more explicitly state in our discussion that these are not discrete categories, as the controls overlap in many cases.

The reviews really helped us understand our data and its significance, as well as better ways to describe the study. I hope these comments help you in your evaluation. If you would like to talk, please give me a call at 215-573-8107.

best,
jon

Forbidden Knowledge in Contemporary Science

Running head: Forbidden Knowledge

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There is growing concern about the politicization and social control of science, constraining the conduct, funding, publication, and public use of scientific research (*1*). For example, human cloning and embryonic stem cell creation have been regulated or banned (*2*), activists have been monitoring and lobbying Congress to defund certain government-sponsored research (*3-5*), and science journal editors were compelled to develop policies for the publication of sensitive manuscripts (*6,7*) following *Science*'s publication of a paper disclosing the synthesis of poliovirus (*8*). These cases are examples of "forbidden knowledge."

Forbidden knowledge embodies the idea that there are things that we can not or should not know (*9-16*). For example, some knowledge is simply inaccessible, such as what transpired in the distant past (*13*); knowledge may be forbidden because it can only be obtained through unacceptable means, such as human experiments conducted by the Nazis (*10,12*); knowledge may be considered too dangerous, as with weapons of mass destruction or research on sexual practices that undermine social norms (*9,10,13*); and knowledge may be prohibited by religious, moral, or secular authority, exemplified by human cloning (*11,13*).

Beyond these anecdotal cases, there are no systematic empirical data about forbidden knowledge in contemporary science. Little is known about what, and in what ways (*16*), science is constrained. To begin to fill this gap, we performed an interview study to examine how constraints affect what scientists do. In 2002-3, we conducted 10 pilot and 41 in-depth semi-structured interviews with a sample of researchers drawn from prestigious US academic departments of neuroscience, sociology, molecular and cellular biology, genetics, industrial psychology, drug and alcohol abuse, and computer science. We chose diverse disciplines to gauge the range, rather than the prevalence, of experiences with the suppression of knowledge.

In-depth interviewing allowed us to cope with the challenge of studying that which does not occur.

We asked subjects to consider their own practices and rationales for limiting scientific inquiry or dissemination, and to tell us about cases in which research in their own discipline had been constrained. Respondents reported a wide range of sensitive topics, including studies relating to human cloning, embryonic stem cells, weapons, race, intelligence, sexual behaviors, and addiction, as well as concerns about using humans and animals in research.

Our results indicate that many researchers (46%) feel constrained by explicit, formal controls, such as governmental regulations and guidelines codified by universities, professional societies or journals. Respondents generally agreed that formal controls offered important protections. Less consensus surrounded the necessity, efficiency, or good sense of specific policies. Stem cell research was repeatedly identified as an example of an overly restricted area. As one respondent argued: "legislators aren't necessarily the wisest people to make decisions about what is good research." Many respondents expressed a preference that scientists – not policy-makers – determine which research is too dangerous.

We were surprised, however, that respondents felt most affected by what we have characterized as "informal constraints." Researchers sometimes only know that they have encountered forbidden knowledge when their research breaches an unspoken rule and is identified by legislators, news agencies, activists, editors or peers as problematic. Kinsey's studies of sexual practices (*17,18),* Milgram's obedience studies (*19*), Humphreys's study of anonymous sex in a public bathroom (*20*), Herrnstein and Murray's analysis of race and intelligence (*21*), and Rind et al's meta-analysis on child sexual abuse (*22)* were attacked only after publication. These well-known cases were mentioned often by our respondents.

Many researchers (42%) described how their own work had been targeted for censure. One researcher was accused by activists of "murderous behavior" because he was incapable of reporting HIV+ subjects who admitted to unsafe sex practices in an anonymous survey. A sociologist attracted the ire of advocates when he published an article that undermined their central claim. In retaliation, the group allegedly accused him of funding improprieties.

In other cases, the mere threat of possible social sanction deterred particular types of inquiry. For example, several researchers said that their choices to study yeast or mice instead of dogs were guided by fears of retribution from animal rights groups. As one respondent commented, "I would like to lunatic-proof my life as much as possible." Drug and alcohol researchers reported similar fears, stating that they would not or could not pursue studies that might provoke moral outrage. Said one respondent: "[W]ho's going to pay cocaine addicts to stay clean? Can you imagine that...on the front page of the [paper]?"

Finally, there may be unspoken rules shared by the community. As one respondent stated, "every microbiologist knows not to make a more virulent pathogen." This may well reflect the experience of scientists who made a more virulent form of mousepox (*23,24*).

We find that researchers' perceptions of the bounds of acceptable behaviors were formed by personal experience of sanctions as well as knowledge of well-publicized cases and stories about colleagues whose work breeched unwritten norms. Half (49%) of our respondents told us these "cautionary tales."

We failed to detect a coherent ethos regarding the production of forbidden knowledge. Respondents at once decried external regulation, and recognized the right of society to place limits on what and how science is done; stated that scientists are "moral" and "responsible," but acknowledged cases in which scientists were sanctioned for performing studies and interpreting

results outside the mainstream of their disciplines; and stated that information and "truth" had inherent utility, but admitted that full and open publication was not always possible. While most respondents worked hard to avoid controversy, others relished in it.

In summary, we find that controversial topics are subject to formal and informal constraints that have a palpable effect on the production of science. Our results suggest that informal limitations on science are more prevalent and pervasive than formal constraints. While formal constraints will bias science – by affecting what is studied and how it is studied – these biases are relatively transparent and amenable to political change. Informal constraints, in contrast, may be culturally ingrained and resilient to change, leaving few markers by which to assess their effects. We believe it is important to observe these constraints, assess their effects, and openly debate their desirability for science and society.

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POLICY FORUM

ETHICS

Forbidden Knowledge

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There is growing concern about the politicization and social control of science, constraining the conduct, funding, publication, and public use of scientific research (*1*). For example, human cloning and embryonic stem cell creation have been regulated or banned (*2*), activists have been lobbying Congress to remove funding from certain government-sponsored research (*3*–*5*), and science journal editors have been compelled to develop policies for publication of sensitive manuscripts (*6*, *7*).

Forbidden knowledge embodies the idea that there are things that we should not know (*8*–*15*). Knowledge may be forbidden because it can only be obtained through unacceptable means, such as human experiments conducted by the Nazis (*9*, *11*); knowledge may be considered too dangerous, as with weapons of mass destruction or research on sexual practices that undermine social norms (*8*, *9*, *12*); and knowledge may be prohibited by religious, moral, or secular authority, exemplified by human cloning (*10*, *12*).

Beyond anecdotal cases, little is known about what, and in what ways, science is constrained. To begin to fill this gap, we performed an interview study to examine how constraints affect what scientists do. In 2002–03, we conducted 10 pilot and 41 in-depth semistructured interviews with a sample of researchers drawn from prestigious U.S. academic departments of neuroscience, sociology, molecular and cellular biology, genetics, industrial psychology, drug and alcohol abuse, and computer science. We chose diverse disciplines to gauge the range, rather than prevalence, of experiences.

We asked subjects to consider their practices and rationales for limiting scientific inquiry or dissemination and to tell us about cases in which research in their own discipline had been constrained. Respondents reported a wide range of sensitive topics, including studies relating to human cloning, embryonic stem cells, weapons, race, intelligence, sexual behaviors, and addiction, as well as concerns about using humans and animals in research.

Nearly half the researchers felt constrained by explicit, formal controls, such as governmental regulations and guidelines codified by universities, professional societies, or journals. Respondents generally agreed that formal controls offered important protections. Less consensus surrounded the necessity, efficiency, or good sense of specific policies. Stem cell research was repeatedly identified as an example of an overly restricted area. Many respondents expressed a preference that scientists—not policy-makers—determine which research is too dangerous.

We were surprised, however, that respondents felt most affected by what we characterize as "informal constraints." Researchers sometimes only know that they have encountered forbidden knowledge when their research breaches an unspoken rule and is identified as problematic by legislators, news agencies, activists, editors, or peers. Studies by Kinsey *et al.* (*16*, *17*), Milgram (*18*), Humphreys (*19*), Herrnstein and Murray (*20*), and Rind *et al.* (*21*) were attacked only after publication. Many researchers (42%) described how their own work had been targeted for censure. One researcher was accused by activists of "murderous behavior" because he was incapable of reporting HIV+ subjects who admitted to unsafe sex practices in an anonymous survey. A sociologist published an article that undermined the central claim of a particular group, who allegedly then accused him of funding improprieties.

In other cases, the mere threat of social sanction deterred particular types of inquiry. Several researchers said that their choices to study yeast or mice instead of dogs were guided by fears of retribution from animal rights groups. As one respondent commented, "I would like to lunatic-proof my life as much as possible." Drug and alcohol researchers reported similar fears, stating that they had not pursued studies that might provoke moral outrage.

Finally, there may be unspoken rules shared by the community. As one respondent stated, "every microbiologist knows not to make a more virulent pathogen."

We failed to detect a coherent ethos regarding production of forbidden knowledge. Respondents at once decried external regulation and recognized the right of society to place limits on what and how science is done. They stated that scientists are "moral" and "responsible," but acknowledged cases in which scientists were sanctioned for acting outside the mainstream of their disciplines. They also said that, although information and "truth" had inherent utility, full and open publication was not always possible. Whereas most respondents worked hard to avoid controversy, others relished it.

In summary, formal and informal constraints have a palpable effect on what science is studied, how studies are performed, how data are interpreted, and how results are disseminated. Our results suggest that informal limitations are more prevalent and pervasive than formal constraints. Although formal constraints will bias science—by affecting what is studied and how it is studied—these biases are relatively transparent and amenable to political change. Informal constraints, in contrast, may be culturally ingrained and resistant to change, leaving few markers by which to assess their effects. We believe it is important to observe these constraints, assess their effects, and openly debate their desirability for science and society.

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