Graduate Education for the Responsible Conduct of Research

Council of Graduate Schools

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COUNCIL OF GRADUATE SCHOOLS

GRADUATE EDUCATION FOR THE RESPONSIBLE CONDUCT OF RESEARCH

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FOREWORD

This is a book designed primarily for senior officers in universities responsible for graduate education. It is aimed at helping deans establish and sustain educational programs on their campuses that foster the responsible conduct of research (RCR). We hope, though, that it will also prove useful for department chairs and faculty members who are planning RCR courses or activities in their departments, and who need to know more about the "best practices" in RCR education.

The book is not intended to provide an overview of RCR education. Though it offers a few examples of case studies used in RCR education, it will not serve as a substantive resource for faculty to use in teaching RCR courses, or for students to consult for developing a better understanding of RCR. Excellent resources for such purposes already exist. These resources are cited throughout the book and are included in the bibliography for the convenience of readers.

One of the primary intentions of the book is to help senior graduate education officers establish a compelling rationale for the training of graduate students in RCR. Many examples and arguments are offered here that can be used to persuade stakeholders in the research enterprise of the urgent need for RCR training. Chief among these stakeholders are research officers and compliance officers, for whom the recommendations provided here may prove useful. The book, though, is not designed to help institutions achieve compliance with federal rules, except indirectly through education. The goal of CGS is to achieve consensus among universities and university officers that RCR training should become a regular, required part of graduate education.

CGS is firmly committed to the institutionalization of RCR education across the graduate curriculum. Readers may find, however, that the focus of this book appears to be on RCR education in the sciences. That is because the funding for the CGS initiative on RCR education was provided by the Office of Research Integrity, which required that the research and demonstration project on which it is largely based be restricted to the behavioral and biomedical sciences. But the

recommendations provided here are intended to apply to the training of graduate students in all disciplines, including the humanities and creative arts.

We at CGS hope that this book will assist our member institutions in advancing the cause of RCR education and in establishing best practices in RCR that will help make graduate education in the United States a model of integrity for the world to emulate.

Debra W. Stewart, President
Council of Graduate Schools

DEFINITIONS

The term "responsible conduct of research," abbreviated throughout this document as "RCR," has a very specific meaning as defined by the Office of Research Integrity (ORI). The ORI usage covers nine "elements," or areas of behavior, in which responsible conduct is central to the reliability and usefulness of research: 1) acquisition, management, sharing, and ownership of data; 2) conflict of interest and commitment; 3) human subjects; 4) animal welfare; 5) research misconduct; 6) publication practices and responsible authorship; 7) mentor/trainee responsibilities; 8) peer review; and 9) collaborative science. These nine elements are closely tied to what are sometimes called "professional standards," the rules for scientific practice explicitly established by disciplinary or professional societies. The term "RCR" may also be used in a wider sense, to include all possible aspects of individual character and behavior that impact research. In this case, the term "scientific integrity" may be used as well, though this latter term can refer not just to the character or behavior of the researcher, but to the reliability of the product of research itself.

Questions about the responsible conduct of research usually, but not necessarily, fall under the broader category of research ethics. Behavior that is labeled "irresponsible" because, for example, it does not conform to professional standards may not be definitively unethical behavior. Unethical behavior will be understood here as behavior that violates accepted ethical principles, such as the principle of autonomy, the principle of beneficence, or the principle of justice. It will include most, but not all, behaviors that are addressed here by the terms "wrongdoing" or "irresponsible conduct."

The word "fraud" has been used historically to name various kinds of deceptive, unethical, or irresponsible behaviors in the conduct of research. Though a number of influential books have used the term, it is now generally avoided in writings on science because of its status in legal

proceedings. The term "wrongdoing" will be used here as a comparable general term to cover illegal, intentionally deceptive, unethical, and irresponsible behaviors.

Wrongdoing by scientists sometimes rises to the level of what is called "research misconduct." This term has been given a very specific meaning by the Office of Science and Technology Policy (OSTP), for the purpose of enforcement of federal policy. The OSTP definition covers primarily what is often abbreviated as "FFP"—falsification, fabrication, and plagiarism (OSTP, 2005). Other behaviors that impact the reliability of research, but are not addressed explicitly in the OSTP definition, are sometimes called "questionable research practices" (Steneck, 2006, p. 59) or "scientific misbehavior" (Martinson, Anderson, & de Vries, 2005, p. 738).

In this document, the term "research misconduct" will be used in the sense determined by the OSTP. Issues of "compliance" will be those issues of compliance with federal policy, not compliance with professional standards or general standards of integrity addressed in what follows. This document does not aim to legislate usage or to restrict connotations of terms that are used. It aims only at consistency and clarity.

INTRODUCTION

Books on ethical issues in science often begin with spectacular stories of wrongdoing, usually by scientists who had formerly enjoyed sterling reputations. Such stories have the familiar ring of Greek tragedy: Highly-regarded scientist-heroes, blinded by hubris, fail to appreciate their limitations and misuse their positions in ways that bring about their own downfalls. The most prominent of these figures—for example John Darsee, Eric Poehlman, and Hwang Wu Suk—have become virtual archetypes, and their stories are repeated regularly in scientific literature as well as in the press. But the popularity of their stories and stories like them attests not just to the timeless revelations about human nature that they provide, but to the appetite of our culture for scandal. And since scientists are commonly taken to be impartial devotees of truth—public servants of the purest motives—their misdeeds make particularly satisfying subjects for scandal.

Scandals surrounding prominent scientists have contributed to declining public confidence in science. This decline has been well documented (LaFollette, 1992, p. 14, 24). Other factors undoubtedly contribute to the decline—for example the alleged politicization of science (Union of Concerned Scientist, 2005), the breakdown of trust generally in the United States, the "culture of cheating" that supposedly permeates the educational system in the United States (Callahan, 2004), or even the so-called "scandal-mongering" press. Whether the decline in public confidence corresponds to a real, verifiable decline in the integrity of science remains a matter for debate. But it seems unlikely that the decline in public confidence will reverse itself without a reduction in the number of misconduct cases that come to the public's attention. And though a continuing decline in confidence may not immediately impact public funding for science—academic research is still widely seen as crucial to innovation and economic growth—the likelihood of more Congressional oversight of science seems to be increasing (LaFollette, p. 26).

As early as 1981, the House Committee on Science and Technology held hearings about serious cases of scientific fraud that had at that time come to light. The prominent scientists testifying before the committee essentially told its members that they were wasting their time. Scientific fraud happens rarely, according to testimony by Philip Handler, then the head of the National Academy of Science. It "occurs in a system that operates in an effective, democratic, and self-correcting mode" (Broad & Wade, 1982, p. 12), he said, referring to the peer-review and referee process that characterizes the system of grant awarding and academic publishing. This opinion continues to be widely held among scientists, twenty-five years later.

The claim that wrongdoing by scientists is exceedingly rare, however, has become more difficult to maintain. Early estimates of wrongdoing were based upon the number of cases of research misconduct reported to the National Science Foundation or the Department of Health and Human Services (Steneck, 2006, p. 57). But the percentage of reported cases that reach this level of adjudication is demonstrably small, and the percentage of cases reported at the institutional level is not well understood. Moreover, there are kinds of wrongdoing—what are often referred to as "questionable research practices" (QRP) or sometimes simply as scientific "misbehavior"—that do not fall under the category of misconduct as defined by the OSTP but that impact the integrity of science significantly. These misbehaviors need to figure into any estimate of the prevalence of irresponsible conduct among scientists.

A study reported in *Nature* in June of 2005, "Scientists behaving badly (*sic*)," poses a strong challenge to the lingering notion that irresponsible conduct by scientists is rare (Martinson, et al., 2005). In this study, ten behaviors were identified by well-informed focus groups from top-tier institutions as likely to be sanctionable—that is, as clear wrongdoing or irresponsible conduct. Approximately 7,000 surveys were sent to mid-career and early-career scientists, asking whether they had witnessed or engaged in these and other behaviors. Thirty-three percent of the respondents said that they had engaged in at least one of the ten sanctionable behaviors.

It is difficult to judge the accuracy of self-reported data of this sort. Many observers claim that wrongdoing is underreported in such surveys. But the data collected in the Martinson study is not out of line with what has been reported in analogous studies of high school and college students, which have tried to estimate the pervasiveness of academic wrongdoing at those levels. Cheating by high school students has been gauged at 74 percent (Josephson Institute of Ethics, 2002) and by college

students at 70 percent (Center for Academic Integrity, 2005). It would be a very sanguine view of human nature, indeed, that would assume that student attitudes and behaviors measured in these studies do not continue into post-baccalaureate education and beyond.

Defenders of the status quo in science will point out that the data collected by Martinson and others show that actual, official misconduct, as defined by the OSTP (fabrication, falsification, or plagiarism), is in fact exceedingly rare. Yet scientists themselves often behave as if at least one of these forms of official misconduct—plagiarism—is not rare at all. Evidence shows that "many scientists will omit important information from papers [under peer review] in order to prevent others from replicating their work before it is published" (Shamoo & Resnick, 2003, p. 81). If serious misconduct by scientists is in fact rare, it would be hard to explain why scientists, presumably rational actors, often fear that their ideas will be stolen by peers.

Many prominent scientists nonetheless continue to cite the presumed "self-correcting" nature of science as the reason for their claims that misconduct by scientists is rare and that funded research in science is therefore in no further need of regulation. However, these scientists often fail to take notice of, or at least to acknowledge, that almost all cases of misconduct are exposed not by the peer-review process, but by whistleblowers (LaFollette, 1992, p. 24, Shamoo & Resnick, 2003, p. 107).

When a whistleblower brings a case of alleged misconduct to an institution's attention, the case is typically adjudicated in accordance with procedures originally mandated by the government for all institutions receiving Public Health Service funds. These procedures must follow guidelines established by the ORI and include review by an institutional inquiry committee, an investigation committee, and a vice president. The results must then be communicated to the ORI, which may itself conduct further investigation. [See Shamoo & Resnick, 2003, pp. 103–109, for a discussion.] But the ORI requires that the procedures be used only for fabrication, falsification, and plagiarism (FFP), which, it is often argued, constitute only a small portion of behaviors that negatively impact the integrity of science. And the official (OSTP) definition of misconduct, which requires evidence of intent to deceive, makes the government rules difficult to enforce.

Questions may arise about how fair the procedures are, even for those who are patently guilty of misconduct. The process of adjudication is not transparent and may take up to ten months (Shamoo & Resnick, 2003, p. 107)—or much longer if the ORI investigates the case. Justice,

then, is not necessarily swift. Penalties imposed for the same offense may vary widely from institution to institution. Moreover, in some cases, accused scientists are given continuing funding while their cases are being deliberated. This has not profited science politically. Presumption of innocence should not mean entitlement to funding, several Congressmen have opined (LaFollette, 1992, p. 22).

It should be no surprise, then, that many stakeholders are calling for more, not less, governmental regulation of science. Dr. Nicholas Steneck, for example, a professor of history at the University of Michigan and a consultant for the ORI, recommends that "government authority for studying and responding to irresponsible conduct in research should be expanded to include behaviors that seriously compromise the public's investment in research or lead to decisions that adversely impact the general health and welfare of the Nation and of individual citizens" (Steneck, 2006, p. 68). Some scientists have proposed instead an expansion and revision of the self-policing strategies of science—for example a required archiving of research data, which could be audited regularly or searched when accusations of misconduct arise. However, so far, no consensus has emerged regarding this issue (Shamoo & Resnick, 2003, p. 105, 111).

An alternative view, and one that is advanced in what follows, is that the most effective way to reduce wrong-doing in research is neither by more government regulation nor by more self-policing, but rather by *education*. In 2002, a committee of the Institute of Medicine and the National Research Council published a review of the research environment, *Integrity in Scientific Research*, which argued that "integrity in research should be developed in the context of an overall research education program" (p. 84). Similar arguments have been advanced by the ORI, which has recently ventured beyond its original function of policing research misconduct to supporting research and education in research integrity. And the development of ethics institutes at many campuses across the country, along with the increasing commitment to ethics courses in the professional schools, is further testimony to the growing commitment of the academy to ethics education.

The view that education will improve integrity in science is not self-evident. The research and demonstration project of CGS, from which the recommendations about best practice in RCR education that follow are drawn, has therefore sought to collect data, through the use of newly developed assessment instruments, that show that ethics education leads to improved ethical reasoning and a higher level of ethical maturity, which can in turn be linked to improved behavior. Much more research

needs to be done, however, and evidence-based arguments need to be advanced regularly and prominently throughout the academy, if the view that education is the best approach to scientific integrity is to be more widely embraced.

In the absence of a large body of evidence supporting the claim that education will by itself improve research integrity, graduate deans are likely to confront opposing views as they try to advance RCR education on their campuses. In addition to the residual view that science is inherently self-correcting and therefore uniquely free of the need for special efforts to ensure integrity, graduate deans may confront the notion that the teaching of ethics is useless because it cannot change behavior. Miscreants will be miscreants, it will be said, no matter what the academy does or does not do. And even those who agree that the teaching of responsible conduct should be part of graduate education may argue that sufficient teaching of RCR is *already* offered in the mentoring of graduate students that invariably takes place in the laboratory and in the informal give-and-take between graduate students and faculty that is part of the educational experience.

This document should help deans counter such arguments and persuade members of the academic community that ethics education is crucial for the professional development of scientists, as it has been found to be for the professional development of physicians and other health-care workers, as well as of businessmen and -women. It should help deans to persuade colleagues that training in RCR can change behavior of students and improve the ethical climate for campus research. Most importantly, it should help deans to plan the steps that are necessary to implement RCR training programs on their campuses and to shape them so that they will be most effective.

CAN ETHICS BE TAUGHT?

Graduate deans trying to establish RCR programs on their campuses, as noted above, may confront colleagues who are skeptical of the effectiveness of ethics education—that is, skeptical of the premise that training in ethics can change behavior. Skeptics may therefore resist curriculum changes, believing that adding ethics courses or course units to a crowded curriculum will simply distract students from more valuable training in their disciplines and not help at all with the institutional or national problem of research integrity.

Some have confronted this challenge by suggesting that training in ethics be limited to training in professional standards (Steneck, 2006). According to this suggestion, students would be trained, for example, in data management, in citation procedures, in rules of authorship, in the protection of intellectual property, etc., and not necessarily in the principles of ethics or in the reasoning strategies of ethical deliberation, which require a different kind of pedagogical expertise and a different means of assessment. Training in professional standards can be provided by departmental faculty and can be advanced, perhaps less contentiously, as professional development. Also, the effectiveness of courses and course units that focus on professional standards can be more easily assessed by objective testing.

Another reason for focusing RCR training on professional standards is that students who engage in misconduct will often say in their own defense that they simply were never taught the rules of their disciplines or their professions. Students caught plagiarizing or "cooking" data, for example, will often say that no one taught them the rules of citation or data management. But such claims are usually not credible. What students typically mean when they make these claims is that they were never taught the *seriousness* of plagiarism or data manipulation, or the *penalties* that are associated with them. This, unfortunately, may be true. And it may be true not because there was no effort to teach students about plagiarism or data management, but because penalties for such

wrongdoing vary dramatically from department to department, college to college, institution to institution, and even country to country.

In any case, the problem with limiting RCR training to training in professional standards is that the latter does not offer a greater promise for changing the behavior of students than training more broadly in ethics. In fact, it may well offer less. The teaching of professional standards as rules to be followed may have little persuasive value if the standards are not carefully and explicitly justified in terms of their ethical rightness. For not all professional standards can be justified in purely "professional" terms, that is, as necessary for the integrity of the research record. Plagiarism, for example, does not necessarily destroy the reliability of research (Steneck, 2006), nor does "honorary" authorship, or lack of informed consent for human subjects. Students need to be taught *why* the standards are what they are, and this cannot be done without employing the principles and reasoning strategies of ethics.

Still, it is far from obvious that those who know the good will do the good, as Socrates claimed 2,500 years ago. Philosophy students steal ethics books from libraries, priests sexually abuse children, and members of ethics committees are censored for violations of conflict of interest rules. Presumably, these kinds of wrongdoers simply do not learn the lessons they are taught, or even the lessons that they themselves teach. Does this mean that their education has been lacking, or, instead, that ethics training (no matter how excellent) cannot change the behavior of people? Though there have been some studies that connect training in ethics with improved behavior, the evidence is preliminary.

To answer the question empirically, it will not do simply to track the number of incidents on a campus that are determined to be cases of research misconduct, and then measure that number against, say, the number of students or faculty who have received training in ethics. It is virtually impossible to know what percentage of actual misconduct investigated cases represent, for these are reported almost exclusively by whistleblowers, whose numbers and commitment will vary widely from year to year and from institution to institution. And multi-institutional surveys designed to tally self-reported misconduct have so far not tried to measure the extent of ethics education that respondents have had.

It might seem, then, a daunting task for a graduate dean without training in philosophy or ethics to confront those skeptics who challenge the usefulness of ethics training. But there are a number of strategies available for doing so that do not require philosophical polemics. In the first place, it should be made clear that ethics training is not aimed solely at achieving compliance with federal regulations, although increased

compliance is clearly one expected benefit of such training. Nor is it designed just to steer potential miscreants away from impulsive misdeeds. Ethics courses are demonstrably useful for well-motivated, responsible students who wish to have guidance in decisions they must make in their research that are not always easy from an ethical point of view. Even students well-versed in professional standards may not know, for example, whether a paper submitted for publication should be withdrawn if later attempts to replicate the data have failed, or whether impoverished subjects can truly give informed consent, or whether subjects who withdraw early from a drug study should be given pro-rated pay. Ethics courses can encourage students to deliberate such issues openly and make responsible decisions as a result.

In this context, it may be worth pointing out that rules being taught in an RCR course, whether they are in the form of professional "standards" or ethical "principles," always need to be applied in concrete situations, and applications of rules are seldom straightforward. This is why there are courses in "applied ethics," "applied mathematics," "applied psychology," and so on. Though courses in "education ethics" or "administrative ethics" are surprisingly rare, most deans will recognize that there are difficult ethical questions in administration as well, about which they themselves can use guidance, and they may therefore be more receptive to RCR courses justified as "applied ethics."

In addition to providing individual guidance, ethics training can work very much like training in "conflict resolution." In ethics courses, students are taught to recognize the principles upon which the arguments of their adversaries depend, to respect those principles and arguments, and to be responsible for answering their adversaries' arguments rationally and persuasively. Ethics training also encourages students to recognize and raise difficult ethical questions, so that ethical deliberation can become more acceptable—and less combative—in professional contexts. This can easily translate into more effective collaboration between researchers.

The ability to resolve ethical disagreements, and therefore to collaborate with colleagues in situations that are inherently contentious, depends upon what might be called "ethical maturity." Ethical maturity can arguably be measured. It can be measured by tests that identify the kind and level of principles being applied to an ethical question, either explicitly or implicitly—principles related to personal need, for example, as distinguished from principles relating to the general good. One such test, the "Defining Issues Test" (DIT), is being used by a number of institutions to assess RCR programs and is well-validated. Though data

from the test has not been correlated with actual behavior of test-takers—i.e., with whether or not they have committed research misconduct—it appears to measure real, behavioral *dispositions* of students. A disadvantage of the test is that it can be "gamed" by devious students. Another is that it is dependent upon a theory of moral development (of Lawrence Kohlberg) that is not universally accepted. Better tests may need to be devised, but the DIT shows that such tests are feasible.

The researchers who published the commentary in *Nature* titled "Scientists behaving badly (*sic*)" (Martinson, et al., 2005, cited above) elaborated on their interpretations of the data later in an article in the *Journal of Empirical Research in Human Research Ethics*, "Scientists' Perceptions of Organizational Justice and Self-Reported Misbehaviors" (Martinson, Anderson, Crain, & DeVries, 2006). This later article should provide graduate deans with convincing reasons to persuade the academic community of the potential effectiveness of RCR training for graduate students. Not only does this study, as stated above, sound an alarm by reporting findings revealing that 33 percent of practicing scientists in their sample admit to sanctionable behavior in the conduct of science; it also identifies the motives of scientists for engaging in such behavior. These motives can be directly addressed in RCR training.

Prominent among the motives for wrongdoing identified in the study, as the title suggests, is the perception by scientists that the system of rewards in the profession is unfair. The study found that scientists who believe that they have not been fairly rewarded for their efforts, either because they have not received grants, tenure, or promotion, or have not had their work published, are more likely to justify to themselves the breaking of the system's rules. An unfair system, misbehaving scientists presumably feel, is not worthy of respect. Other possible motives for misbehavior were identified, for example, "intrinsic drive" and "strain," but only the hypotheses related to perception of injustice were tested using the data collected for the study.

The positive correlation between the perception of unfairness and actual wrongdoing in science reported in the study suggests several educational strategies to reduce research misbehavior. Certainly, as the authors propose, "Early introductions to expectations, work norms and rewards associated with academic careers, as well as a solid understanding of peer-review processes, will help scientists . . . to recognize and deal openly with injustices" (Martinson, et al., 2006, p. 63). Peer-review and other reward systems in academia are addressed in Preparing Future Faculty programs, long advanced by CGS and

implemented at numerous member institutions. But if the perception of injustice in the system is to be reduced, the teaching about the reward system in academia needs to be explicitly connected to questions of procedural justice, which are best addressed in courses or course elements that examine the system from the point of view of ethical principles.

Even if the system's procedures are clarified and shown to be basically fair in their structures, the very scarcity of rewards in the system may lead students to see the system still as inherently unjust—that is, as inherently incapable of rewarding equal efforts equally. But the question of distributive justice upon which this perception is based could be at least partly addressed if institutions were to take upon themselves the ethical responsibility of publicizing time-to-degree statistics and job-placement statistics of graduates, so that applicants could understand the challenges they will be facing both as matriculated students and as doctoral graduates. CGS has advanced this strategy as a "best practice" in its Ph.D. Completion and Attrition project.

Transparency in the reward system can help change perceptions in another way as well. Collective, systemic efforts to make the system of rewards transparent exhibit a commitment by an institution to fairness and integrity. The visibility of this commitment can improve what is now often called the "ethical climate" of an institution.

Growing evidence suggests that the ethical climate of an organization influences behavior, perhaps more than the ethical standards of individuals within the organization (IOM & NRC, 2002, pp.144–49). As ethical issues in research become more and more visible through public lectures, seminars, workshops, and graduate courses and course units, and as faculty address the issues more and more frequently in their classes and in their mentoring, even those graduate students tempted to trespass the boundaries of responsible conduct will find it harder to do so. Bright light has always been the best deterrent to crime.

Graduate deans, then, can counter skepticism about the effectiveness of ethics education by advancing ethics education as the central factor shaping the ethical climates of their institutions. And graduate deans, as visible campus officers well-positioned to promote ethics education, can themselves influence the ethical climate, by playing leadership roles in promoting awareness of ethical issues and by deliberating them in public forums. Though the term "ethical climate" may lack precision, graduate deans can contribute to the usefulness of the notion by insisting on the development of assessment instruments to define and measure it.

IS ETHICS RELATIVE TO CULTURE?

Graduate deans may confront a current of resistance to ethics education that does not always rise to the surface, but may nonetheless be present in the minds of many faculty. Though they may not hold the position publicly, many faculty and students will consider ethics education to be a useless exercise, because the principles taught in ethics courses, they will say, and the notions of right and wrong that go with them, are not universal, but merely cultural artifacts, as ephemeral and variable as the cultures from which they are drawn. This is the position sometimes known as "moral relativism." Moral relativists may resist a wide-ranging ethics education in favor of the simple teaching of the rules of research, or professional standards.

Some critics say that so-called moral relativism has infected the academy to the extent that ethics is impossible to teach there at all. According to such criticism, advanced perhaps most famously in *The Closing of the American Mind*, by Alan Bloom (1987), students today are incapable of making moral judgments and thereby are poorly equipped to become responsible moral agents. The fault, these critics say, lies with so-called "liberal" professors, who object to any definitive stand about the rightness or wrongness of a behavior on the grounds that values can never be "absolute." Such professors may agree that standards of behavior need to be taught in the laboratory, to insure the dependability of the research product, but they will not agree that standards should be taught in the context of "theories of ethics," which they hold are reductionist, essentialist, or even imperialist.

The accusation by Bloom that faculty who fit this caricature in fact dominate the academy remains unproven. But there are at least some faculty—and many students—who will describe their positions as "relativist," and base their resistance to traditional ethics education upon this very concept. And to the degree that such faculty do not examine the concept of relativism, or deliberate it publicly, their positions are no less "ideological" than those of so-called ethical "conservatives" such as

Bloom, whom they oppose. Only a proper ethics education can provide the context for deliberating the issue.

In any case, what critics like Bloom usually do not recognize, and what those promoting ethics education need to understand, is that even self-described "relativists" typically base their opinions on a principle that must be taken as fundamental. For "relativism" is often just the name that Americans give to the position that people should be allowed to be self-determining. This actually is not relativism at all. It is a commitment to what ethicists call "the principle of autonomy," one of the three or four principles upon which morality is typically built. That so-called "relativists" will usually balk at declaring prohibitions against murder to be merely relative to culture, and not universally valid, is evidence that they are not relativists in the literal sense at all.

An example might help to illustrate this point. Bloom begins his classes, and his book, with a question about a form of suicide called *suttee*, once practiced in India by widows, but eventually outlawed during the British Raj. In *suttee,* a widow would jump into the funeral pyre of her husband, supposedly voluntarily. Bloom asks his students, "If you had been a British administrator in India, would you have let the natives under your governance burn the widow at the funeral of a man who had died?" Those who answer "no" may do so for a simple but compelling reason: the innocent life of the woman should be saved. Implicit here is a moral principle that one should not harm innocent people, a principle that ethicists call the principle of "non-maleficence" (sometimes taken to be a part of the principle of beneficence, the principle that one should do what one can to help people). A choice to intervene to save the woman's life might also be defended on the principle that women should be treated the same way as men, a principle drawn from the more fundamental principle ethicists call "the principle of justice."

Those who would have let the widow die in the fire might say that they are relativists, and that they believe that one should "leave other people alone." But their beliefs show that they have a common commitment, indeed, a moral commitment. They are committed to the principle of autonomy. One can argue that they are applying the principle wrongly—that the principle cannot be applied to cultures as a whole, because cultures are not moral agents, only individuals are—but not that they are unprincipled. It is worth noting, too, that those opposed to their position might similarly embrace the principle of autonomy and agree that it is the appropriate moral principle to bring to bear in this case, but still disagree about what in fact should be done. It is irresponsible for either party to accuse the other of moral laxity or of unprincipled beliefs.

Professor Bloom's question is, after all, not an easy one to answer. Those who would intervene on the basis of the principle of autonomy—that the widow should be allowed to be self-determining—must establish that the widow in fact does not want to die, in fact is in a frame of mind in which she cannot act autonomously, or in fact is being coerced by other members of the family or tribe, etc. Those who would on the other hand refrain from intervening on the basis of the very same principle, must explicitly establish the "will" of the culture. To posit a "culture" that would condone such acts would require selecting some segments of the society as representative while marginalizing other dissenting segments of that same society, including some that may welcome the salutary effects of outside influence on a "human rights" issue. And those who would choose instead to intervene, on the basis of the principle of non-maleficence, must establish that intervening would not bring about more bloodshed. The matter is far from simple. A responsible answer to Bloom's question, then, would require not just a commitment to principles, but a careful examination of facts and a careful deliberation of how the ethical principle germane to the situation is to be applied.

Science itself proceeds in much the same way. Scientists do not throw out an established principle of science when researchers fail to get the same results in a laboratory. In fact, they *expect* differences in laboratory results, depending upon the competence of the researchers, the accuracy of the instruments, the contaminating factors that cannot be eliminated, and so on. A dizzying variety of factors is typically taken into account in the testing of a hypothesis, and the success or failure of an experiment may depend as much upon the deliberations regarding the experimental design as upon any straightforward application of principles. Final and absolute answers in science are not easy to get, any more than they are in ethics.

It is perhaps worth pointing out that the birth of science was contemporaneous with the birth of modern ethics, in Greece, in the several centuries before the Christian era. And perhaps the most prominent "ethicist" in the history of the West was Socrates, who famously refused the moral arguments of his friends that he should escape the sentence of death, which had been unjustly imposed upon him for his constant questioning of cultural orthodoxies. Socrates did not find an "absolute" resolution to the ethical questions surrounding his behavior, but raised the glass of hemlock and declared that *in the absence of a better argument*, he was obliged to drink it. Responsible behavior, if Socrates can be believed, does not depend upon rigid certainties.

The difficulty with ethics, then, is not that there are no dependable principles to serve as guides to behavior, but that there are so few easy applications of such principles. Neither faculty nor students need to throw up their hands in despair when easy agreement cannot be reached about ethical questions. They can be taught that there are ethical principles that can be responsibly held in common with others and that these principles do not automatically yield answers to difficult questions—as if ethicists could just program principles and facts into computers and let the computers make ethical decisions automatically. Thus one influential ethical thinker, Soren Kierkegaard, held that all truly responsible ethical decisions are made "in fear and trembling." Those who are confident of their opinions on moral questions probably have not thought about them, he believed, because if they had, they would see the many, many factors that need to be taken into account, and would be humbled by them.

Nonetheless, even those who embrace universal principles in ethics, and support traditional ethics education in research and in the professions, may on occasion take positions that are very much like those of self-described relativists. Deans may, for example, confront colleagues who insist that international students need special RCR training that domestic students do not. International students sometimes reinforce this position by claiming in self-defense that they were never taught what plagiarism is or that plagiarism is tolerated in their countries of origin. Deans should be very skeptical of these claims and very careful not to insult other international students—or international faculty—by setting up special RCR classes for them that would imply that they are somehow ethically deficient. And they should recognize that ethics is often taught effectively in multicultural contexts. In fact, many ethics teachers will claim that multicultural contexts are the very best contexts in which to teach ethics.

IS RESEARCH ETHICS ALREADY BEING SUFFICIENTLY TAUGHT?

There are sometimes said to be three responses to suggested reforms: "It won't work," "Great, let's do it," and "We're doing that already." The latter is arguably the most difficult to deal with. Many faculty will claim, with some justification, that RCR education is already offered in their graduate programs, in research and methods courses, in laboratory instructions, and in mentoring generally. The question, however, is whether existing efforts in RCR education are sufficient. And to achieve faculty buy-in for new RCR curricular elements, faculty will need to be persuaded that they are not.

An article in *Physics Today*, "Ethics and the Welfare of the Physics Profession" (Kirby & Houle, 2004) confirms that at least in the discipline of physics, ethics education is "largely informal," occurring mostly in the context of out-of-class discussions with faculty. The survey on which the article is based is primarily aimed at education in the area of data collection and recording. It does not try to determine what else, in the general area of RCR, is being covered in these informal exchanges. But it does establish that there is a significant gap between what students believe they are learning and what faculty say they are teaching.

In their responses to the survey, nearly 80 percent of undergraduates in physics reported that what they have learned about "professional ethics" has come from discussions with faculty. Only a little more than 20 percent said that they have been taught about professional ethics in formal courses. Over 45 percent of department chairs in physics, on the other hand, said that professional ethics is taught in the formal curriculum, and about 65 percent say that the issues are taught in student-faculty consultations (Kirby & Houle, 2004). Though these percentages may of course be different for graduate students, and though they may vary from discipline to discipline, the evidence suggests that faculty may think they are doing more than they are, and that in any case what they are doing is mostly informal and cannot verifiably be said to cover all the important topics in RCR.

The question, then, is not just whether RCR is being taught, but whether it is being *sufficiently* taught. Any advocacy of RCR training programs on campus must make clear that the ORI sets out nine areas of instruction, or "elements," that need to be covered in order for graduate students to learn what they need to know about RCR (http://ori.dhhs.gov/education/). The nine elements are as follows:

- Acquisition, Management, Sharing, and Ownership of Data
- Conflict of Interest and Commitment
- Human Subjects
- Animal Welfare
- Research Misconduct
- Publication Practices and Responsible Authorship
- Mentor / Trainee Responsibilities
- Peer Review
- Collaborative Science

Particular departments will be quick to point out that some of these elements—e.g., human subjects research and animal welfare—are not relevant to their fields. But given what is known about RCR training from surveys that have tried to estimate its occurrence on campuses, few departments will be covering all of the other areas, which are indeed relevant to their fields. In any case, there are many issues in RCR—in the category, for example, of "questionable research practices" (QRP) addressed earlier—that may not fall within these nine elements.

If it is true that a comprehensive program in RCR will include training not just in the nine areas listed by the ORI, but in QRP and in ethical decision-making, it may be the case that departmental faculty are not prepared to teach it. Many mature RCR programs will therefore have philosophy faculty involved, or will have sent disciplinary faculty to workshops or training programs to prepare them for teaching ethics. Mature programs will be teaching not only professional standards, but the subtleties involved in their application, the larger categories of the nine elements under which they fall, the ethical questions that are raised in QRP, and the skills and principles of ethical reasoning required to resolve difficult issues.

BEST PRACTICES IN RCR EDUCATION

This document recommends six interventions that have so far emerged as "best practices" in developing and implementing training programs for graduate students in RCR. These practices have been distilled primarily from the experiences of the institutions receiving awards under the CGS/ORI project, "Graduate Education for the Responsible Conduct of Research." This project was designed as a research and demonstration project to develop, test, and assess strategies for integrating RCR education into graduate education in the behavioral and biomedical sciences. A contract with ORI enabled CGS to fund ten competitively-based awards of $15,000 each, to assist member institutions in the planning and implementation of pilot programs on their individual campuses. Twenty-five institutions that applied for awards but did not receive them, were established as "affiliates" in the program and were invited to participate in the discussions shaping these recommendations.

CGS also received a grant from the NSF, "Ethics Education in Science and Engineering," effective January, 2006, to provide eight more awards of $15,000 to member institutions to develop and implement interdisciplinary research-ethics programs for graduate students in the relevant areas. The NSF-funded project covers different disciplines from the ORI-funded project and is aimed at training students to recognize, articulate, and deliberate ethical issues that arise in interdisciplinary research and in public-policy arenas. Assessment strategies for the NSF project include measurement of both individual ethical reasoning skills and the ethical climate of the research units involved.

CGS / ORI RCR Project Awardees

Arizona State University	University of Kansas
Duke University	University of Missouri—Columbia
Florida State University	University of New Hampshire
New York Medical College	University of Rhode Island
Old Dominion University	University of Utah

CGS / ORI RCR Project Affiliates

Boston College
Chicago School of Professional Psychology
Clemson University
Columbia University
Eastern Washington University
Florida International University
Fordham University
Hood College
Howard University
Michigan State University
Purdue University
San Diego State University
Towson University
University of Arkansas
University of Arkansas—Little Rock
University of California—Davis
University of Hawaii—Manoa
University of Illinois—Urbana-Champaign
University of Maryland—Baltimore County
University of Massachusetts—Amherst
University of North Carolina—Chapel Hill
University of North Carolina—Charlotte
University of Wisconsin—Madison
Utah State University
Western Michigan University

As more research on research integrity emerges, both generally and in other fields, and more experience is gained from the NSF-project and from programs that are now being put into place at institutions not directly funded by CGS, the recommendations that follow will be revised and amended.

1. ESTABLISHING AN ADVISORY BOARD

In order to strengthen the ethical climate for research on a campus, it is necessary that the institutional leadership exhibit its commitment to academic integrity prominently and not only through periodic public statements or occasional references to the topic in campus publications. A very good way of doing this is for the central administration to establish a permanent, officially recognized "steering committee" or "advisory board" for RCR, consisting of high-profile senior faculty members whose reputation is beyond reproach, as well as graduate student representatives and representatives from the graduate school or graduate council. The committee should have a clear charge from the institutional leadership, so that its very existence would amount to a structural change in the

university curriculum and/or governance system. Its suggestions and proposals, then, could not be ignored or delayed by ad hoc or other university committees.

The steering committee or advisory board would develop, deliberate, and advance RCR educational interventions throughout the institution. It might be set up to report to the Graduate Dean, the Graduate Council, or the Provost. Its charge should be to promote campus-wide awareness of RCR through public forums, as well as to design and propose curriculum strategies to expand and improve RCR training for graduate students. Finally, it might be charged with assessing the institution's efforts in this regard, so that individual research programs are held accountable for what their students learn or do not learn about RCR.

It is important that such a committee's proposals and suggestions not be confused with "policing" efforts to achieve compliance with federal regulations. Though in many cases the Graduate Dean who would establish the committee is also the chief research officer in charge of compliance, the committee's charge can be clearly and explicitly stated as educational in nature, and it can be prominently announced as entirely unconnected with compliance processes. Some of the institutions participating in the CGS/ORI project have suggested naming the committee in such a way that it cannot be suspected of being connected to the enforcement or policing functions of the office of research. The very word "ethics," for example, sometimes connotes to faculty a kind of rule-governed orthodoxy—and one of suspicious provenance—that threatens to restrict their academic freedom or autonomy. But if the name of the committee were framed in such a way as to emphasize, say, professional development of graduate students, its suggestions might be less impulsively resisted. Institutions should be careful, though, to insure that the name of the committee reflects publicly the institution's commitment to integrity in research, scholarship, and creative activity. Different institutional cultures may dictate different naming strategies, as well as different organizational ones.

If the graduate school at an institution is organizationally separate from the office of research, collaboration with the chief research officer may be necessary to insure that the activities of the steering committee do not overlap with, or intervene in, the research office's functions, but rather complement those functions. Compliance strategies of the research office, for example, will in most cases involve mandated RCR training for those connected with NIH-funded training grants. Training modules or workshops for this purpose may already have been developed by the

office of research. Campus-wide RCR activities or educational initiatives advanced by the steering committee may thus need to be coordinated with the research office.

It may be the case, too, that while the research office is responsible for enforcement of policies regarding research misconduct, the graduate school may have policies regarding academic dishonesty, which require enforcement as well, and may at times overlap with the policies of the research office. It is recommended that the enforcement responsibilities of the graduate school be kept separate from those of the research office, some of which are federally mandated, and that the functions of the steering committee on RCR be kept separate from all kinds of enforcement. The charge to the steering committee is best restricted to matters that are exclusively educational.

The steering committee may have more influence if it is given responsibility for assessment of RCR programs, or recommending assessment strategies to departments. The committee could develop its own assessment tools or recommend tools already developed and validated by others. The committee may be in a better position to review the current literature on research integrity than individual faculty and to share what has been learned with departments. Recent studies, such as the Martinson study discussed earlier, could be reviewed, discussed, and, when appropriate, disseminated across campus by the steering committee, along with recommendations based upon them.

A permanent steering committee of the sort discussed here offers the prospect of sustained RCR activity on campus and of sustained commitment to the effectiveness and accountability of RCR programs. Graduate deans are best situated on campus to sustain campus-wide graduate educational initiatives, but it must be remembered that even graduate deans come and go, and the vitality of RCR programs should in no case be the responsibility of a single campus officer.

2. PROVIDING PUBLIC FORUMS

The climate of research at an institution can be enhanced by well-publicized, regularly offered public forums on RCR, featuring national figures or experts where possible. These forums, or programs, can be designed to address ethical issues that are pressing both from the point of view of the general public as well as of scientists, for example, stem cell research, global warming, or genetically modified foods. Or they can be designed to address what is known to the public as "scientific fraud," focusing on examples of misconduct that have been well-reported

in the press and that have captured the public's attention. They can also be addressed primarily to faculty and graduate students, by focusing on issues of immediate concern to bench scientists, such as authorship practices or conflict of interest. The inclusion of nationally known guest speakers, as one of the participating institutions noted, "promotes the seriousness and global significance" of RCR training.

Such forums serve not just the purpose of educating the public and the university community about the ethical dimensions of scientific practice, but also of exhibiting the institution's commitment to integrity in research. They provide opportunities for senior administrators to appear before concerned members of the community and take leadership roles in the advancement and promotion of RCR education, thereby contributing directly to the strengthening of the ethical climate on their campuses.

The steering committee or advisory board for RCR education can be given the charge of conceiving, developing, and advancing such public programs. This will ensure broader representation of university and community interests and, if there is effective student participation on the committee, of student concerns as well. The collective knowledge of the members of the committee can be drawn upon for recommendations for topics and for speakers.

Donald Kennedy, the editor of the prestigious journal *Science*, has publicly lamented that faculty may be interested in RCR education but that students are not, because students are impatient to get through their degree programs and get on with their careers and will typically reject time-consuming enterprises not immediately leading to their goals. Evidence from the CGS/ORI project suggests a more positive view of student engagement. It is true that some of the public forums introduced on the campuses of the ten institutions participating in the CGS/ORI RCR project were not well-attended by students. But others were very well-attended. In fact, the experience of the participating institutions shows that student demand can drive RCR program expansion. The problem, then, does not lie in any lack of interest of students, but in the strategies employed in setting up the programs.

Student leadership can be consulted to optimize student interest and student attendance at forums. It can be useful for the steering committee to involve not just the campus-wide graduate student organization, but the different departmental student organizations, where these exist. If they do not exist, department chairs can be enlisted by the steering committee or by the graduate dean to find student volunteers to serve on focus groups to help shape the public programs. Given the opportunity to work directly with departmental faculty, or a university committee of other faculty,

students can usually be persuaded to become involved, especially where the issues addressed are related in some way to their research. These students can then serve as informal leaders among their peers to encourage attendance.

The forums can, of course, be made mandatory for a certain small number of students, for example, those currently enrolled in RCR courses or in research methods courses whose instructors are committed to RCR education. But these are the students likely to attend such events in any case. And it should be expected that some forums will draw more students from certain disciplines than others, depending upon the issues that are addressed and how they are addressed. A forum on ethical issues in research with human subjects cannot be expected to draw students from physics. But a forum, say, on the desirability of a required data auditing system for all funded research, with a segment on the special ethical problems with data about human subjects, might attract students from the behavioral as well as the physical sciences, and might address ethical issues crossing all disciplines, such as those related to authorship or to intellectual property. If forums that are inclusive of the interests of students from all departments cannot be set up, a series of forums can be offered, sequentially aimed at different disciplines.

These public forums should not be developed to take the place of RCR courses or course elements taught by faculty, which can address ethical issues in detail and develop ethical reasoning skills in students. These forums, though, can provide opportunities for RCR education not provided in coursework or in individual mentoring by faculty. They can provide opportunities for students to participate in public policy debates, and to bring to these debates the knowledge of science and of research practice that bears upon them. For one of the goals of RCR education is to train scientists to participate in, and inform, public policy debates. Informed and engaged scientists can help ensure that these debates are not left entirely to lay persons or politicians, thus attenuating the dangers of a "politicization" of science, against which the Union of Concerned Scientists has warned in its public statement of February of 2005.

The ORI has advanced, and the CGS RCR project attempts to reinforce, the position that RCR education for graduate students should not be limited to one course or to one course unit, but should be integrated throughout each degree program as a pervasive feature of graduate education. Public forums can be one important piece of such an effort. They can provoke dialogue between faculty mentors and students, raise questions that are not raised in seminars or RCR courses, and keep

ethical issues in the foreground for students, even when these students are not enrolled in any formal coursework related to RCR.

A useful example of the effectiveness of public forums in changing the ethical climate of a university or its programs can be found in medical education. Twenty-five years ago, before ethics education was integrated formally into the curricula of medical schools, public forums on ethical issues in medicine were common, and were frequently advanced and sponsored by universities. Physicians, educators, and members of the public often attended such forums and exchanged ideas. Hospital ethics committees began to be established, partly in response to federal mandates, but also in response to public concern about certain features of the practice of medicine. Eventually, ethics committees were required by hospital accreditation agencies. Medical school curricula followed the trajectory of public concern expressed in these developments.

3. OFFERING TWO-TIERED INSTRUCTION

Evidence from institutions participating in the CGS/ORI project suggests that graduate students respond best to RCR training that is directly relevant to their experience as graduate students. Students are more likely to be engaged, too, when their mentors or program faculty are involved in the teaching of RCR. No RCR training program, then, should be without departmental-level, disciplinary programs with involvement and commitment from program faculty.

Nonetheless, there is good reason for RCR training not to be limited to course work or instruction within a department or offered exclusively by departmental faculty. In the first place, departmental faculty may not be prepared to teach RCR. Though they may be perfectly familiar with the ethical standards that govern their respective disciplines, in many cases they will not have had training in ethical reasoning or in the most effective strategies of teaching RCR. In fact, participating institutions report that many faculty are reluctant to teach RCR because they do not feel themselves to be qualified.

This obstacle is often overcome by involving faculty from other departments. Team teaching of RCR courses, with philosophy faculty or other faculty with experience in applied ethics, has proven a popular and effective strategy. Of course, scheduling problems, course-load conflicts, or funding issues may make it difficult to arrange for regular team teaching. An ongoing commitment by college deans and by central administration is therefore crucial to the sustainability of the team-teaching approach and should be confirmed during the planning phase for new or expanded RCR education.

Another strategy for overcoming the obstacle of faculty reluctance to get involved in RCR course teaching is to send departmental faculty to seminars and workshops designed for just this purpose. The Poynter Center for the Study of Ethics and American Institutions at Indiana University provides excellent venues for faculty training in ethics. Disciplinary associations may also sponsor or announce programs for faculty that can improve their skills for teaching RCR. Institutions may wish to establish "train the trainers" programs on their own campuses, to create a cadre of teachers well equipped to offer instruction in RCR. At one participating institution, members of this cadre are called "Research Ethics Faculty Fellows."

One risk of limiting RCR training to departmental-level instruction is that such instruction can focus too narrowly on objective learning of professional standards and not enough on the skills of applying professional standards or the ethical principles upon which they are based. The primary interest of departmental faculty may be to enculturate students into their disciplines, and not to develop their "characters" or otherwise try to inoculate them against misbehavior. Perspectives from outside the discipline, on the other hand, may prove challenging and broadening for students, assuming that such perspectives can be introduced in ways that capture the interest of students—that is, by expert teaching.

In any case, participating institutions have found that certain features of RCR education lend themselves to interdisciplinary approaches and can be more efficiently, and even more effectively, taught in interdepartmental formats. The substance and force of fundamental ethical principles, for example, can be exhibited best by showing the extent of their reach. Ethical reasoning skills can be developed effectively by invoking them in contexts that are not necessarily familiar to students—contexts that force students to adopt new positions and new strategies of thinking. The challenge for teachers is to win students' attention in arenas beyond their immediate concerns, but experience shows that this can be effectively accomplished, for example, by introducing "hot button" issues like stem cell research, or by focusing on cases of misconduct that are prominent in the press at the time.

Interdisciplinary, cross-departmental seminars and coursework also help train graduate students to address non-specialist audiences, audiences not familiar with the orthodoxies of their disciplines. Not only do interdisciplinary educational strategies train students to articulate technical details of their disciplines in clear terms understandable to a lay audience; they also train students in the art of persuasion, that is, in the skill of

articulating and responsibly defending ethical positions related to the practice of science or of their scholarly professions. This can be particularly helpful if one of the explicit goals of RCR education is to equip students with the ability to enter into public policy arenas to advance the interests of their disciplines.

Interdisciplinary RCR courses or seminars are best housed in the office of graduate studies. Many institutions already have procedures for interdisciplinary programs and coursework that are overseen by the graduate school, and RCR training can therefore be implemented more easily by leadership from the graduate dean. Sustainability will also be enhanced by the support of the office of graduate studies and by the oversight of the graduate council or graduate committee.

Like the two "best practices" discussed above, the practice of two-tier RCR education both requires and exhibits the commitment of the university administration to integrity in research. The housing of interdisciplinary RCR courses in the graduate school can impress upon students the seriousness of the topic and can contribute explicitly to an "ethical climate" in the university that reinforces responsible conduct.

4. TEACHING ETHICAL REASONING SKILLS

A major justification for offering "two-tiered" instruction in RCR is to provide students with training in ethical reasoning skills, which may not always be a feature of departmental courses, in part because faculty themselves typically have not had training in ethics. Faculty may even resist such training, seeing it as unnecessarily disputatious and not effectively leading either to an improved understanding of professional standards or to responsible conduct itself.

Ethical reasoning, however, does not necessarily begin with disputation nor involve disagreements between people with different opinions. The first step in ethical reasoning is often simply the identification of ethical issues—that is, of questions about the rightness or wrongness of behavior, about which reasonable people may disagree. If RCR is taught primarily as conformance to professional standards, and taught in a context where everyone shares exactly the same perspective, legitimate ethical issues may be overlooked. This was arguably the case, for example, in medical research many years ago, before informed consent by patients and human subjects was required, when the rights of patients and subjects were often not fully recognized or understood. Part of the reason for federal regulations regarding human subjects, and part of the justification for using a "two-tier" approach in RCR education, is

to ensure that multiple perspectives are brought to bear in research so that all significant ethical issues can be identified.

Nor is training in ethical reasoning simply training in the construction of arguments, arguments that might be cynically invoked, say, to justify positions already taken. Students who are taught ethical reasoning are, to be sure, taught how to construct arguments, that is, how to move deductively from general ethical principles to particular conclusions. However, the purpose of such training is not just to help students defeat weaker arguments in order to defend themselves or to effect a change in the opinions of adversaries. The purpose is primarily to help students develop consistency, coherence, and confidence in their opinions and behaviors.

Training in ethical reasoning also involves training in inductive reasoning, that is, training in moving from opinions or behaviors back to the principles that underlie them. Students can be taught how to recognize ethical principles that are implicit in the positions of others, even when those others do not understand or recognize the principles themselves. Such recognition is often the first step in the respect for others. And it is central to the resolution of conflict and the improvement of collegiality in the conduct of research, particularly in the wake of new discoveries, when ethical questions arise for which there is no easy answer, for example in the areas of stem cell research or genetic engineering.

Steps in ethical reasoning that are often taught as a part of applied ethics courses (Elliot & Stern, 1997, p. 12) are in fact very much like steps taught in conflict resolution. Minimally, they involve first an identification of issues; second, a collection of the relevant facts; third, a respect for other stakeholders and the principles upon which their various positions depend; fourth, a consideration of all feasible alternative positions and the principles that underlie them; and finally, a negotiation with stakeholders to agree upon and implement the best option. If such steps are followed by graduate students in their research, they will be led to engage faculty and peers in ethical issues, and they will not be left on their own to worry about possible ethical violations or about whether to become "whistleblowers" with regard to practices of others in their labs about which there is room for disagreement. They will also be better prepared to write grant proposals that must take into consideration ethical implications that have come to the public's or the granting agency's attention.

Ethical reasoning can be seen to go hand in hand with what has been referred to in the introduction as "ethical maturity." Ethical maturity involves the disposition to draw upon broader perspectives, or more

fundamental principles, in arriving at positions or deciding to act in certain ways. It requires alertness to ethical issues and consistency in the application of ethical principles. It requires respect for the opinions of others and the confidence to question one's own opinions.

One of the most important justifications for training in ethical reasoning is the contribution that it can make to students' abilities to participate effectively in public policy debates. In its influential monograph, *On Being a Scientist*, the Committee on Science, Engineering, and Public Policy of the National Academies of Science held, "if scientists do find that their discoveries have implications for some important aspect of public affairs, they have a responsibility to call attention to the public issues involved" (COSEPUP, 1995, p. 29). Graduate programs, then, have a responsibility to prepare future scientists for the social responsibility that goes with being a scientist. And a significant part of such preparation is training in ethical reasoning.

Though it is not typically the role of a graduate dean to become involved in pedagogical issues, it is important for deans to recognize that the teaching of ethical reasoning is largely the teaching of "applied" ethics. That is, the teaching of ethical reasoning is the teaching of *how* to do something, not *that* something is the case. Ethical reasoning may require knowledge of professional standards or of ethical principles, but its teaching is primarily the teaching of a skill. Thus its teaching characteristically requires experienced, if not expert teachers.

Because the kind of knowing that is developed in courses on research ethics is a "knowing how" as opposed to a "knowing that," texts on the topic almost universally proceed by the use of case studies. And the deans involved in the CGS/ORI project agreed that the case-study approach was most effective in winning student and faculty engagement in RCR issues. But they agreed, in addition, that the teaching of case studies is a difficult thing to do, requiring experience at guiding discussion toward particular outcomes, and should not be left to teaching assistants or inexperienced faculty. Team teaching of RCR courses by faculty whose combined backgrounds cover both the scientific issues in the relevant case studies and experience in ethical reasoning was identified by participating deans as a particularly effective practice.

5. MAKING RCR TRAINING MANDATORY

All ten institutions participating in the CGS/ORI research and demonstration project on RCR education agreed that RCR education should be made mandatory for all graduate students. Of course, all

institutions agreed that this is a very difficult thing to do, and it may have to be accomplished incrementally, over many years. Moreover, graduate schools cannot easily themselves mandate coursework for departments—there is little enthusiasm on campuses for so-called "top-down" initiatives—and departments, for many reasons, may resist even elective coursework in RCR.

Departmental faculty will need to be persuaded of the importance of RCR education, or, in many cases, of the importance of expanding any existing efforts at RCR education. Strategies for doing so have already been mentioned: using surveys to exhibit the differences in perceptions regarding RCR training of graduate students and faculty; administering pre-curriculum and post-curriculum tests about the nine elements of RCR to assess growth in understanding of RCR elements among graduate students; and conducting public forums that raise awareness about the occurrence of scientific fraud and its damage to scientific integrity and to public confidence in science.

Of course, even if departmental faculty are persuaded of the importance of RCR education—and many will need no persuasion at all—faculty may still resist making RCR courses mandatory. There are often good reasons for such resistance. In the first place, disciplinary curricula have become very crowded, partly driven by growing knowledge in the disciplines and partly driven by professional associations or disciplinary accrediting agencies. Adding yet another requirement to an already long list is not an attractive prospect for faculty, particularly if faculty believe that RCR education is already being provided in existing research and methods courses or informally through mentoring.

Second, faculty availability to teach RCR courses or course elements may be severely limited by tightening budgets. A new course on RCR will involve real delivery costs, whether they are costs for a TA to teach an undergraduate course for a faculty member reassigned to an RCR seminar or costs to cover the course itself. Moreover, where team-taught RCR courses are developed, departments may lack a faculty workload policy that can easily accommodate the instructor who chooses to participate part-time in an RCR course and who has a complex set of assignments in the department that need to be adjusted. Leadership from the graduate dean may become important in facilitating such adjustments.

An effective strategy used by several of the institutions participating in the CGS/ORI project was to offer small grants to departments for the development of the needed RCR courses or course elements. This strategy helps to establish ownership of the courses within the

departments and contributes to the expansion of the cadre of faculty committed to RCR education. It also helps with the project of making RCR courses mandatory. Of six courses funded and developed in this way at one of the participating institutions, four were made mandatory by the departments involved.

The very practice itself by a graduate school of distributing seed money to fund start-ups of departmental RCR programs can provide a certain cachet for those programs, especially when the source of the funding is a prominent national agency. It can also exhibit in even one more way the institution's commitment to RCR education, which in itself can provide a rationale for making RCR courses mandatory.

Some institutions have found it relatively easy to persuade departments to embed RCR education into existing voluntary programs, such as Preparing Future Faculty programs, or Preparing Future Professional programs, or to set up other new voluntary programs, such as "Research Ethics Fellows" programs, that will lead to the recruitment of a good proportion of graduate students for RCR education, and thus serve as an incremental step toward an eventual departmental mandate for RCR education. The disadvantage of such approaches is that RCR education remains voluntary, and therefore not foregrounded as an essential feature of graduate education. But the experience of many deans is that elective courses can establish their importance after their advantages become well-known, and then can become more readily accepted into the required curriculum later.

A common approach to the advancement of RCR education is to embed RCR segments into existing courses or to expand RCR segments that are already embedded in existing courses. If these existing courses are mandatory, then RCR education becomes automatically mandatory. A danger here is that the RCR segments may be taught by the same person who has been teaching the course for years, and who may be more inclined to address professional standards than, say, the nine elements of RCR or current and vexing ethical issues in science. Faculty who teach the courses, then, will need to be thoroughly trained in RCR education and, of course, not privately resistant to it. Oversight and promotion by the RCR steering committee can help to ensure the effectiveness of these courses and course segments.

Courses in RCR offered outside the department, such as interdisciplinary courses developed by the graduate school as part of the recommended "two-tier" approach to RCR education, may encounter obstacles all their own. Many students may initially resist interdisciplinary courses, saying that they prefer courses taught by their own

departmental faculty, presumably because they believe the latter to be more important to their field of study and because the topics explicitly addressed will be closer to their own research. But interdisciplinary courses, taught with skill and alertness to student interests, can easily win student acceptance. Participating institutions, in fact, report that students have responded enthusiastically to campus-wide seminars and programs. The key to acceptance lies in effective teaching, which is of crucial importance in moving these kinds of courses toward a permanent place in the curriculum.

A second obstacle to mandatory interdisciplinary RCR courses may be state or institutional funding formulae, which reward departments for credit-hours generated within their curricula. Interdisciplinary courses, taught by non-departmental faculty and with course numbers not linking them to the department, may unintentionally reduce the assessed "productivity" of a department and any funding connected to it. Care will have to be taken that the funding formulae and other policies about departmental enrollments and faculty workload do not disadvantage departments whose students participate in the "two-tiered" approach to RCR education.

At some institutions, culture and tradition may actually allow the graduate school to "impose" mandatory RCR education upon departments, that is, to win sufficient support of the graduate council for advancing RCR training as a requirement for a graduate degree. It is worth pointing out that the one institution among the ten participating institutions in the CGS/ORI project that was able immediately to do so is a medical school. Medical schools, and other professional schools, have long been able to mandate ethics training for practitioners, partly because of departmental culture, but also because of leadership from professional associations and accrediting agencies. To the degree that graduate faculty see themselves and their students analogously as "professionals," the professional programs can be seen as meaningful precedents, and as further reason for science and liberal arts disciplines not to eschew ethics training for graduate students.

The traditional boundary between professional graduate programs and research graduate programs is in fact being eroded. Many institutions, with the support and encouragement of CGS and the Sloan and Ford Foundations, have established professional master's programs, aimed at training professionals for immediate entry into the workforce, rather than for further graduate study in research Ph.D. programs. These professional programs are not dominated by disciplinary faculty and may be particularly receptive to ethics education, as other professional programs,

such as business, medicine, and engineering have proven to be. Because these professional master's programs typically have advisory boards consisting of leaders from business and industry, suggestions for curriculum changes are more readily accommodated and can include recommendations for required RCR training.

Though mandatory RCR coursework may be difficult for a graduate school to establish unilaterally, there are individual actions that a graduate school can take to keep RCR education in the foreground for students and for departments, regardless of the level of departmental receptivity to mandatory RCR education. Graduate schools often administer exit surveys as requirements for students' application to graduate. These surveys could include RCR questions, the results of which could be used in public ways to assess the effectiveness of departmental curricula, and indirectly to encourage more RCR education at the departmental level. Graduate schools can encourage the "outside" members of thesis or dissertation committees to ask RCR questions and to report back to the graduate school the level of sophistication of students in this area that students have achieved. Strategies such as these, which are being piloted by CGS member universities to change the "ethical climate" in graduate programs, could lead eventually to universal RCR education.

6. DEVELOPING MULTI-LEVEL ASSESSMENT

Because RCR is an institutional commitment, and not just a curricular element that happens to be common to various graduate programs, it should be overseen by a central university office, preferably the graduate school. Ideally, the graduate school, together with the RCR steering committee, will implement and manage assessment of programs, to ensure not only their effectiveness but their breadth of coverage of the major components of RCR. Assessment will be required at the departmental and course level, and at the level of the individual student. And assessment of the many different aspects of RCR will need to be implemented, making assessment truly a multi-dimensional task.

The institutions participating in the CGS/ORI project have found assessment to be the most difficult of all challenges in establishing quality RCR programs. That is partly because the purposes of assessment are manifold. No single assessment instrument, administered at a single time to students in their research programs, or to faculty once during an academic year, will provide a complete picture of educational quality. Multiple assessments will have to be made, often using the same

instrument as a pre-test and then as a post-test, to measure what has or has not been accomplished by a particular phase of the program.

Assessment instruments will in many instances have to be approved by the university's institutional review board (IRB). When assessment instruments are used to produce research that is not limited to educational outcomes within a single course or program—for example, to compare institutional outcomes with those of peer institutions—a formal IRB approval will be necessary. Though the approval of an assessment instrument by an IRB at another institution may legally have force on a second campus, the collection and archiving of data at the second institution may present issues that its IRB should address, so it is safe to assume that the IRB should review any assessment instrument, whether approved by another institution's IRB or not. Strategies for protecting confidentiality of survey respondents will have to be well documented.

The first assessment that can be profitably made, prior to the implementation or even development of a program, is of students' perception of the RCR training that they have received. Students' perceptions of the extent and quality of RCR training in a department can be compared, using the same instrument, to faculty perceptions. Experience shows that students typically perceive that they are receiving much less RCR training than faculty believe they are offering, and that they are receiving it primarily on an informal basis, with no insurance that all topics of RCR are covered. Data from such assessment can be used, as stated earlier, to persuade departments to expand RCR education in their curricula. The assessment instruments can then be used at a later date, to see whether RCR programs have indeed impacted students' perceptions about the effectiveness of the training they are receiving. Institutions participating in the CGS/ORI project are developing such an instrument, which CGS hopes can be made available to member deans in the future.

Once an RCR program is established, a number of other assessment strategies will be necessary to gauge the program's success. It should be noted that final examinations for coursework, designed and administered by faculty, may not be sufficient to help an institution assess its success with RCR education. Assessment of program quality may need a comparative basis in order to be reliable. Well-validated assessment instruments used across disciplines and across institutions are particularly valuable and can help individual programs identify their strengths and weaknesses and focus upon specific educational goals.

The assessment strategies chosen will in fact define the goals of the individual RCR program. Given what has been said in the sections above,

RCR education should include instruction in the "nine elements" of RCR identified by the ORI, an introduction to professional practices of a discipline, training in ethical reasoning, and exercises that advance the ethical maturity of students. RCR education should also contribute to the ethical climate of the department and the university. All of these dimensions of RCR education can be measured in pre-tests and post-tests to gauge effectiveness of programs.

An instrument assessing knowledge of the "nine elements" of RCR has been developed by researchers at Vanderbilt University with funding from the ORI. This test has been piloted and should soon be available for CGS institutions to use. Institutions may adapt this or other tests for their own uses, but if institutions use them in their validated form, they will be able to compare their outcomes with those of other institutions, and plan revisions or improvements in their RCR programs as appropriate.

The ORI has also funded the development of a test to measure reasoning skills acquired in ethics training, though at the time of publishing of this document, the test was not yet ready for general use. CGS hopes eventually to help pilot and/or examine this test for possible inter-institutional research. But institutions in the meantime may have to develop their own instruments to measure skills of ethical reasoning that their RCR programs promote. Philosophy faculty may be helpful in this regard.

One institution participating in the CGS/ORI project is using a previously developed test, referred to in the introduction above, called the "Defining Issues Test" (DIT), to measure improvement in ethical sensitivity and ethical maturity of students enrolled in its RCR program. This test is available from the University of Minnesota and is well-validated. Though, as already mentioned, it is often criticized for its heavy dependence upon a single theorist (Lawrence Kohlberg), it has the advantage that its results can be compared to those at other institutions. Institutions may wish, however, to develop their own tests for ethical maturity, at least until other, more acceptable, tests are available. Psychology faculty may need to be consulted to do so.

Discussion among participating institutions has included consideration of the need to assess the "ethical climate" in a research unit in order to measure the challenges of RCR education. The ten institutions, however, did not attempt to develop or identify a specialized or single instrument for this purpose, given the amount of time and expertise that such an enterprise would require. Examples of ethical climate measures developed for use by various organizations other than universities are provided in *Integrity in Scientific Research* (pp. 143–163), published by

the National Academies. Some of these measures may be adapted for use in RCR programs. It is an indication of how much work is still to be done, that the call from the National Academies for better assessment of ethical climates within universities has yet to be answered. Future editions of this document will identify progress in this regard as it occurs.

OTHER PRACTICES

Institutions participating in the project incorporated a number of other practices into their RCR programs that cannot be easily summarized, and in many cases not easily reproduced, since they are dependent upon different university cultures or funded in a way not achievable at all CGS member institutions. Only a few of these other practices are mentioned here, to suggest the variety of different strategies that might be used to achieve the same educational goals.

Almost all institutions adopted some form of web-based instruction, either by using existing online material, or, when they were not satisfied with the quality of online training available, by developing training modules themselves. All institutions established RCR Web sites, with a preference for sites not associated with compliance. These institutional Web sites include online surveys, online tests, and in one case, a page for the "ethics problem of the week," which offers students or other members of the community a chance to communicate with each other online about possible solutions to the problem.

One institution established an "RCR Fellows" program, to train individual graduate students, who could then participate as leaders in other RCR activities. Some institutions have established RCR certificate programs, so that students can graduate with a permanent record of having been trained in RCR. One institution set up a collaboration between nursing and chemical engineering, to exploit the interdisciplinary opportunities in RCR education.

Participating institutions generally preferred a combination of strategies ranging from workshops to seminars to brown-bag lunches to orientation retreats. Workshops for mentors were also advocated, though they were admittedly not easy to implement. All institutions agreed that RCR education should be integrated throughout students' courses of study, and, where possible, broken into units that are organized to match the times in students' educational careers when the particular issues addressed are most pressing.

ETHICAL OBLIGATIONS OF UNIVERSITIES

The Martinson study about misbehavior in science, discussed earlier (p. xii–xiii), suggests that the perception of injustice in the reward system of science is a prominent motive for misbehavior by researchers. Hence, as has already been said, effective education in RCR will include at the very least a thorough explanation of the peer-review, grant-award, and tenure systems. But education about the multi-faceted reward system may not be enough to reduce motivation for misbehavior, if the Martinson study is accurate. The reward system will itself need to be fair, and transparently so.

Though individual graduate deans cannot by themselves ensure fairness in the peer-review practices of journals or of granting agencies, they can work to make the system of rewards for graduate students on their own campuses both fair and transparent. Graduate deans may review institutional and departmental systems for awarding teaching assistantships and research assistantships, and make improvements where appropriate. Though many students will arrive on campus with fellowships or assistantships in hand, it is important that both they and their unfunded peers understand how the awards were made, and that the process was deliberate and fair. Students are also entitled to know how work assignments within a department are made, how mentors are officially assigned, and how travel money for graduate student presentations is distributed.

It is also a good practice to provide applicants to graduate programs with clear and unambiguous data regarding their employment prospects after completing their degrees. Collecting such data, though, will require careful tracking of graduates. Graduate deans can be the leverage points in making this occur. They may draw upon the experience of professional programs, many of which already have systems of tracking students that can serve as models for other departments. Alumni associations can also be of great help in this regard.

Publicizing the resultant data can be done in many ways. It may not be sufficient simply to post the data on the graduate school or

departmental Web site. The data can also responsibly be included in cover letters with application packets, or prominently displayed on the online application page. For failing to collect such data, withholding it from applicants, or de-emphasizing it by hiding it on a link deep into a Web site, amounts to denying applicants important information necessary for their career choices. Like all withholding of information that limits a person's ability to make decisions, not providing even informally known employment data to applicants is a violation of the principle of autonomy and may significantly contribute to student perception of unfairness in the academy.

Other data that can help applicants to graduate school make informed decisions about matriculation should be both gathered and carefully disseminated. In order to make the most informed decisions, applicants need to be told in advance of matriculation the average time to degree of students in a program, the average debt burden of graduates, and the kinds of jobs and the average starting salaries students in a program receive upon graduation. While it is difficult to collect such information, given limited resources of graduate programs and graduate schools, its dissemination communicates respect for students and contributes to their perception of being treated well.

The CGS initiative on Ph.D. Completion and Attrition has already been promoting the collection and dissemination of these kinds of data, in order to help students make informed decisions about matriculation. Preliminary evidence from this initiative suggests that the selection process itself, which is typically a two-way negotiation between applicants and faculty, is a key to improving completion rates. An informed applicant pool, and a robust selection process, will make for better matches between student and faculty expectations, and this can reduce dissatisfaction and attrition within programs.

In some cases, employment or time-to-degree data may appear discouraging to prospective students. Faculty may believe, consequently, that publication of such data will reduce the number of qualified applicants. But time-to-degree issues can be addressed within departments, and employment data collected by departments can be supplemented by data from the U.S. Census Bureau, which show unambiguously the economic value of graduate degrees (Cheesman Day & Newburger, 2002). The overall data on employment of graduates with advanced degrees is not discouraging at all, at least from a purely economic standpoint.

In any case, students may be more likely to apply to, or matriculate at, universities that have clear ethical commitments. A survey conducted

by Universum Communications ("For college grads," 2006) showed that undergraduates rank preferred employers more in terms of their ethical standards (39 percent) then by the employer's financial strength (26 percent). If undergraduates are impressed by an organization's commitment to ethics and will want to be employed by those firms or agencies that exhibit it, they may similarly prefer matriculating for graduate study at universities that exhibit the highest ethical standards in their treatment of students.

The collection and dissemination of employment and time-to-degree data also have another important function. They contribute significantly to the ethical climate of an institution. They amount to a clear announcement by an institution that it will behave responsibly. An institution that itself behaves responsibly can more credibly expect responsible behavior from its students. Evidence suggests that students at such an institution, in turn, will be more likely to conform to its expectations.

CONCLUDING REMARKS

The research on which this document is based is provisional. The ten RCR programs at the member institutions participating in the CGS/ORI project are essentially pilot projects, and they continue to evolve. CGS plans to fund the implementation of eight more RCR programs through an NSF grant begun in 2006. The collective experiences of these funded institutions, along with the experiences of many more CGS member institutions whose deans will be participating in conference sessions and online discussions, will eventually add to what is known about best practices in RCR education.

Important new research findings on RCR are also continuing to appear, some of which may alter approaches to RCR education significantly. The study of misbehavior in science by Martinson, et al. (2005) is just one example. The behaviors reported in the Martinson study need to be explored in other settings. And given the contention surrounding the Martinson article, more such work is likely to be undertaken. The ORI will continue to fund research through its Research on Research Integrity (RRI) program. CGS member deans can follow RCR research developments on the CGS and ORI Web sites.

In spite of a growing body of evidence that RCR education is both necessary and effective, many deans will continue to encounter resistance to the establishment of substantive RCR programs on their campuses. This text, and the research on which it is based, should help deans to overcome such resistance. But overcoming resistance will probably take a number of years. It might be instructive to consider, in this regard, what has happened in medical education. Not so many years ago, ethics training in medicine was strenuously resisted by many physicians and medical school faculty, who believed that the only significant issues in medicine were medical issues, not ethical ones. Today, that position is a minority position, and ethics education has become a regular feature of medical school curricula. The effort needed to overcome resistance and affect this transformation had to be a sustained one.

CGS anticipates a similar need for sustained effort if RCR training for graduate students is to become institutionalized as a regular feature of graduate education in the United States. Accordingly, CGS plans to follow up its advancement of ORI-funded pilot programs and of second-phase, NSF-funded implementation programs with continuing sessions on RCR at CGS national meetings and continuing communications with members about RCR education. What is known about "best practice" in RCR education, then, will continue to expand. This document, accordingly, will be revised, and, CGS hopes, will continue to serve as a useful, evidence-based guide to graduate deans for establishing RCR programs on their campuses.

BIBLIOGRAPHY

Bloom, A. (1987). *The Closing of the American Mind.* New York: Simon & Schuster, Inc.

Broad, W., & Wade, N. (1982). *Betrayers of the Truth: Fraud and Deceit in the Halls of Science.* New York: Simon & Schuster, Inc.

Callahan, D. (2004). *The Cheating Culture: Why More Americans Are Doing Wrong to Get Ahead.* Orlando, FL: Harcourt.

Center for Academic Integrity. (2005). CAI Research—Don McCabe [On-line]. Available: http://www.academicintegrity.org/cai_research.asp

Cheeseman Day, J. & Newburger, E.C. (2002, July). The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earnings (U.S. Census Bureau Report No. p23–210) [On-line]. Available: http://www.census.gov/prod/2002pubs/p23–210.pdf

Elliott, D., & Stern, J.E. (Eds.). (1997). *Research Ethics: A Reader.* Hanover, NH: University Press of New England.

For College Grads, Money Isn't Everything. (2006, May 8). CNN Money.com [On-line]. Available: http://money.cnn.com/2006/05/08/news/economy/jobs_survey/index.htm

Glanz, J. (2004, February 19). Scientists Say Administration Distorts Facts. *The New York Times*, p. A28.

Kirby, K., & Houle, F.A. (2004, November). Ethics and the Welfare of the Physics Profession. *Physics Today Online*, 57(11), 42. Available: http://www.physicstoday.org/vol-57/iss-11/p42.html

Institute of Medicine and National Research Council. Committee on Assessing Integrity in Research Environments. (2002). *Integrity in Science Research: Creating an Environment That Promotes Responsible Conduct.* Washington, DC: The National Academies Press.

Josephson Institute of Ethics. (2002). Survey documents decade of moral deterioration: Kids Today Are More Likely to Cheat, Steal and Lie Than Kids 10 Years Ago [On-line]. Available: http://www.josephsoninstitute.org/Survey2002/survey2002-pressrelease.htm

LaFollette, M.A. (1992). *Stealing into Print: Fraud, Plagiarism, and Misconduct in Scientific Publishing.* Berkeley, CA: University of California Press.

Martinson, B.C., Anderson, M.S., & de Vries, R. (2005). Scientists Behaving Badly. *Nature,* 435(9), 737–738.

Martinson, B.C., Anderson, M.S., Crain, A.L., & DeVries, R. (2006). Scientists' Perceptions of Organizational Justice and Self-Reported Misbehaviors. *Journal of Empirical Research on Human Research Ethics*, 1(1): 51–66.

National Academy of Science, National Academy of Engineering, and Institute of Medicine. Committee on Science, Engineering, and Public Policy. (1995). *On Being a Scientist: Responsible Conduct in Research* (2nd ed.). Washington, DC: The National Academy Press.

Office of Research Integrity. (2004). *Introduction to the Responsible Conduct of Research* by N.H. Steneck. Washington, DC: U.S. Government Printing Office.

Office of Research Integrity. (2006, June). Research Misconduct Activity Rebounds in 2005 reports. *Office of Research Integrity Newsletter*, 14(3): 2.

Office of Science and Technology Policy. (2005). Federal Policy on Research Misconduct [On-line]. Available: http://www.ostp.gov/html/001207_3.html

Shamoo, A.E., & Resnik, D.B. (2003). *Responsible Conduct of Research.* Oxford, UK: Oxford University Press.

Steneck, N.H. (2006). Fostering Integrity in Research: Definitions, Current Knowledge, and Future Directions. *Science and Engineering Ethics*, 12(1), 53–74.

Union of Concerned Scientists. (2004, February 18). Statement: Restoring Scientific Integrity in Policymaking [On-line]. Available: http://www.ucsusa.org/scientific_integrity/interference/scientists-signon-statement.html

Whitbeck, C. (2004, November). Trust and the Future of Research. *Physics Today Online*, 57(11), 48. Available: http://www.physicstoday.org/vol-57/iss-11/p48.html

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