

**The Ethics
of Scientific
Research**

The Ethics of Scientific Research

A GUIDEBOOK FOR COURSE DEVELOPMENT

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Why Teach Research Ethics?

Recently, one of us (J.E.S) had the opportunity to speak with a medical student about a research rotation that the student was planning to do. She would be working with Dr. Z, who had given her the project of writing a paper for which he had designed the protocol, collected the data, and compiled the results. The student was to do a literature search and write the first draft of the manuscript. For this she would become first author on the final publication. When concerns were raised about the proposed project, Dr. Z was shocked. “I thought I was doing her a favor,” he said innocently, “and besides, I hate writing!”

Dr. Z is perhaps a bit naive. Certainly, most researchers would know that the student’s work would not merit first authorship. They would know that “gift” authorship is not an acceptable research practice. However, an earlier experience in our work makes us wonder. Several years ago, in conjunction with the grant from the Fund for the Improvement of Post Secondary Education (FIPSE), a team of philosophers and scientists at Dartmouth College ran a University Seminar series for faculty on the topic “Ethical Issues in Scientific Research.” At one seminar, a senior researcher (let’s call him Professor R) argued a similar position to that of Dr. Z. In this case Professor R knew that “gift” authorship, authorship without a significant research contribution, was an unacceptable research practice. However, he had a reason to give authorship to his student. The student had worked for several years on a project suggested by him and the project had yielded no publishable data. Believing that he had a duty to the student to ensure a publication, Professor R had given the student some data that he himself had collected and told the student to write it up. The student had worked hard, he said, albeit on another project, and the student would do the writing. Thus, he reasoned, the authorship was not a “gift.”

These two stories point up a major reason for encouraging courses in research ethics: Good intentions do not necessarily result in ethical decisions. Both of the faculty members in the above scenarios “meant well.” In both cases, the faculty members truly believed that what they were doing was morally acceptable. In the first case, Dr. Z’s (indefensible) error was that he was unaware of the conventions of the field. In particular, he seemed blissfully oblivious to the meaning of first authorship. In the second case, Professor R was doing what he thought best for the student without taking into consideration that morality is a public system and that his actions with regard to a single student have public consequences for the practice of science as a profession.

Well-meaning scientists, such as those just mentioned, can, with the best of intentions, make unethical decisions. In some cases, such decisions may lead individuals to become embroiled in cases of misconduct. A course in research ethics can help such scientists to appreciate that it is their responsibility to know professional conventions as well as to understand the public nature of morality.

There are scientists for whom a course in research ethics will be less useful. Efraim Racker,¹ in a 1989 article, described a student in his lab who was a “professional” fabricator of data. This student composed lab books without performing experiments, added radioactive material to gels to produce bands where he wished those bands to be, and lied to his colleagues about his actions. Another researcher, Elias Alsabti, described by D. J. Miller,² was a meticulous plagiarizer. This physician-researcher fabricated his curriculum vitae, copied a colleague’s grant for his own use, published other people’s data under his own name, and co-authored his pilfered data with fictitious collaborators. Individuals such as these are unlikely to learn research ethics through instruction because they are not interested in becoming ethical practitioners.

The ethics of scientific research is somewhat unique within professional ethics in the sense that good science requires the ethical practice of science (this is discussed in more detail in Section 4). Nevertheless, a course in research ethics cannot and should not have as its central focus the question, “Why should I be moral?” This question, while important, is not specific to the field of scientific research. A course in research ethics, as envisioned by the Dartmouth team, must be a course that teaches the tools for making ethical decisions relative to matters of research. It will be designed for those scientists who are already committed to being ethical researchers. Such a course should provide students the answers to the question, “How can I make moral decisions?”

Although it is the fabricators and the plagiarizers whom we most often think of when we think of research misconduct, these are not the only people accused of misconduct. They are also not the only people who are guilty of misconduct. Many other scientists have had lives and careers affected by misconduct cases.

It is undoubtedly unfair to generalize from a few cases of misconduct to an entire profession. Nevertheless, reported cases of misconduct are not uncommon, and this could reflect a failure to train students to the highest ethical standards. The 1993 Office of Research Integrity (ORI) publication reported the 1991–1992 caseload to include 29 institutional inquiries, 21 institutional investigations, and 7 ORI inquiries or investigations.³ The 1995 ORI publication reported the 1994 caseload as 13 institutional inquiries, 17 institutional investigations, and 8 ORI inquiries or investigations.⁴ Of actions closed in these years (55 in 1991–1992; 44 in 1994), some involved fabrication, some falsification, some plagiarism, and others some combination of fabrication, falsification, plagiarism, and “other misconduct.” Slightly fewer than half of the investigated cases closed as of these reports were found to involve misconduct and resulted in sanction against the accused party. The academic rank of the accused ranged from technician to full professor. Cases were reported from a number of institutions, and the accused parties were funded by a variety of funding sources.

Cases of misconduct are not simple matters to evaluate. One source of concern is confusion within the field of science about just what constitutes a punishable infringement of ethical standards. In the fields of engineering, law, and medicine, clear written guidelines exist for defining ethical conduct. Although some particularly difficult cases may test the limits of these guidelines, most do not. In scientific research, a written code of conduct is not available.⁵ The federal government⁶ and individual institutions⁷ have been struggling to clarify the standards under which misconduct can be adjudicated. The central definitions that delineate misconduct in science include fabrication, falsification, and plagiarism. However, these are confused by other less clear categories of misconduct, which include “other questionable behavior” or “other misconduct.” Within this confusion of definitions it is not always obvious to students or faculty where and toward whom their obligations lie.

Complicating the confusion generated by the way in which we define research misconduct is the teaching process by which students routinely learn about the ethical obligations of their profession. Traditionally a scientist trains with a single mentor. From this mentoring relationship the graduate student is expected to learn about scientific method, the body of knowledge that constitutes the specific field of science she is studying, and the “institution” of science. What is learned about the institution of science includes knowledge of the mechanics of obtaining funding, information on the writing of grants and papers, and an understanding of the roles and responsibilities for maintaining and sharing research data. As part of her instruction in all of these areas, it is assumed that she will also learn the ethics of scientific research.

In the case of the story of Dr. Z above, it is clear that Dr. Z’s relationship with his mentor did not result in his having learned a basic convention of the field. So, it is not surprising that Dr. Z was prepared to pass his unrecognized confusion to a student who was working with him. Mentoring relationships within science education do not necessarily result in adequate familiarity with the ethics of research.

Judith Swazey of the Acadia Institute has studied this issue and presents some very distressing data on the efficacy of mentoring relationships in graduate education.⁸ Although 89% of 2,000 graduate student respondents from 98 departments of major research institutions said that they related to a single faculty member who was particularly supportive of their work, less than 45% of students felt that this faculty member gave them “A lot” of help toward teaching them the details of good research practice, and 15 to 20% of the students felt that the help they got in this area was “None.” Fewer than 45% of students believed that they got “a lot” of helpful criticism on a regular basis.⁹ In the majority of cases, students felt that their faculty support person did not provide the type of mentoring relationship that one would hope for in the ethics training of a research scientist.

When Swazey asked students to compare the role that a department should take in preparing students to recognize and deal with ethical issues in their field to the role **actually** taken by the department, her results were equally disturbing. Eighty-two percent of students felt the department should take an “Active” or “Very active” role in this process, while only 22% felt that an active or very active role was actually taken.¹⁰

The perceptions of faculty were not much different from those of the students. Ninety-nine percent of 2,000 faculty members surveyed felt that “academics should exercise collective responsibility for the professional conduct of their graduate students”; only 27% of these faculty felt that they followed through with this responsibility.¹¹

These data provide evidence to indicate that individual mentoring is a less than adequate teaching method for ethics. If the majority of students do not receive mentoring that leaves them with a clear understanding of their responsibilities as scientists, then cases of unintentional misconduct and questionable practice are inevitable.

The role and importance of ethics education have begun to be recognized by the NIH. Guidelines for NIH research training grants now require a minimal number of hours of ethics education.¹² Ethics need not be taught within a single graduate course, but it is beginning to be recognized that education in the basic conventions of the field and in the basic approaches to ethical decision making can no longer be left to one-on-one mentoring alone. As the ever-dwindling availability of research funds fuels the fire of competition, there will be increased pressure on scientists to bend or break rules. Research laboratories, particularly large groups where some students rarely see their faculty advisors, cannot be assumed to teach research ethics, or even to train students in all research conventions.

Whether scientific ethics is approached through a single course or a series of courses or seminars throughout the graduate curriculum, it has become obvious that students need exposure to ethics in a number of contexts. Research ethics can and must be taught in a formalized manner. It is our belief that courses in research ethics that incorporate a solid philosophical framework have the greatest potential for long-term usefulness to students. While other methodologies may reinforce this material, a course of the type described in this monograph has the potential to help a student develop the tools to see ethical problems from a new vantage point. It is in this context and for these reasons that we designed our course in research ethics.

Notes

1. E. Racker, "A view of misconduct in science," *Nature* 339 (May 11, 1989):91–93.
2. D. J. Miller, "Plagiarism: The case of Elias A. K. Alsabti," in **Research Fraud in the Behavioral and Biomedical Sciences**, chapter 5, ed. D. J. Miller and M. Hersen (New York: John Wiley & Sons, 1992).
3. U.S. Department of Health & Human Services, **Office of Research Integrity Biennial Report 1991–92**, Public Health Service, Rockville, Md. (September 1993).
4. U.S. Department of Health & Human Services, **Office of Research Integrity Annual Report 1994**, Public Health Service, Rockville, Md. (April 1995).
5. R. A. Gorlin, ed., **Codes of Professional Responsibility**, third edition (Washington, D.C.: BNA Books, 1994). The 1994 edition contains codes of conduct for groups ranging from the American Institute of CPAs and the National Association of Realtors to the American Nurses Association and the American League of Lobbyists, but has no codes of conduct for scientists or scientific research.
6. Panel on Scientific Responsibility and the Conduct of Science, **Responsible Science: Ensuring the Integrity of Scientific Responsibility and the Conduct of Research**, vol. 1 (1992) and vol. 2 (1993) (Washington, D.C.: National Academy Press).
7. Council on Sponsored Activities, **Dartmouth College Policy and Procedures for Safeguarding Integrity in Research, Training, and Other Related Activities** (rev. September 1995).
8. J. P. Swazey, "Teaching research ethics: Needs, opportunities, and barriers in graduate programs," background paper for meeting of NSF Consortium Project: The Production of Educational Modules for the Teaching of Research Ethics, Lake Bluff, Ill., April 2–4, 1993. Published versions of some of these data include: J. P. Swazey, K. S. Louis, and M. S. Anderson, "The ethical training of graduate students requires serious and continuing attention," **Chronicle of Higher Education** 9 (March 1994):B1–2; J. P. Swazey, "Ethical problems in academic research," **American Scientist** 81 (Nov./Dec. 1993):542–53.
9. Students had the choices of "A lot," "Some," and "None."
10. Swazey, "Teaching research ethics," 1993, 6–7.
11. Swazey, Louis, and Anderson, "Ethical training," 1994, B-2.
12. National Institutes of Health and Alcohol, Drug Abuse, and Mental Health Administration, "Reminder and update: Requirement for instruction in the responsible conduct of research in National Research Service Award Institutional training grants," **NIH Guide for Grants and Contracts** 21 (43, 1992):2–3.

In answer to the question, “Who needs research ethics?” many of us might answer, “I don’t need it, but that guy over there certainly does.” The situations related in Section 1 indicate that at least some “of those guys over there” could profit from an opportunity to discuss ethical problems that arise during their research.

The vast majority of scientists doing research have had no formal training in research ethics. If Judith Swazey’s data are correct, students have been poorly mentored in research ethics, and faculty who were trained by the same methods may themselves be lacking an ethics education. Conventional wisdom that may or may not be handed down from mentor to student probably differs widely from laboratory to laboratory. Scientists generally operate under the faulty assumption that everyone agrees about what constitutes reasonable conduct.

During our faculty University Seminar in Research Ethics we found that nearly every issue engendered lively debate. Nearly every point discussed became a point of contention. As an exercise at one of the University Seminars, we had participants evaluate a series of case vignettes. Scenarios included funding, collaboration, publication, sexual relationships between mentors and students, fabrication, and maintaining lab notebooks. The responses made clear that there was little agreement between scientists on some fundamental issues. There was no agreement, for example, on who should keep lab notebooks and on how long they should be kept. There was little agreement on who should be first author on a paper from a collaborative project. Faculty differed widely on perceived appropriateness of student-mentor sexual relationships and on what constituted an appropriate response to reports of data fabrication.

In the course of this three-year project, we have come to believe that when we ask the question, “Who needs research ethics?” our answer must be, “practicing scientists.” All scientists engaged in research can benefit from the discussion of research ethics. This doesn’t mean that the study of ethics will answer questions about how long to keep a lab notebook or who should be first author on a paper. Ethics education is not about finding the “correct” answer. Nevertheless, discussion of ethical issues allows scientists to grapple with and develop strategies for recognizing, approaching, and resolving ethical problems.

The value one places on training in research ethics may be proportional to what one feels can and should be accomplished through ethics education. As already addressed in Section 1, we do not believe that ethics education should have the goal of teaching someone why they should be moral. University Seminars, courses in ethics, and other forums for ethics debate serve a function only for those scientists who already wish to be ethical researchers. For such scientists the discussions in such forums allow them to evaluate conventions, define responsibilities, articulate positions on different issues, and acquire some facility at using a framework for ethical decision making.

Discussion of conventions has merit even when different scientists cannot agree on what a particular convention should be. For example, discussion can lead to effective strategies for avoiding conflict. In the case of laboratory notebooks, one can ensure that a clear policy on who keeps notebooks is articulated before the research is undertaken. Similarly, in the case of first authorship, discussion of authorship before a project is undertaken can be encouraged. In the first case scenario in Section 1, Dr. Z would have benefited from a discussion of conventions. Gaining the knowledge that there are written guidelines for authorship in most journals would in itself have been helpful to him.

Conventions may differ significantly from one field of science to another. The order of authorship in one field may reflect the level of involvement in the experimental protocols, while in another field it may reflect an alphabetical listing. Practices for replication of experiments may also differ. Large population-based psychology experiments may not be expected to be repeated prior to publication, while assay results of a physiology experiment may be expected to be repeated several times. Though conventions themselves may differ, certain consistent themes can be clarified by these interactions. For example, no matter what the research practice is regarding replication in a particular field, it is ethically unacceptable for scientists to lie about what they are doing. If they report that they are showing a “representative experiment” when they only did the experiment once, they are misrepresenting the experiment. An additional advantage to discussion of conventions is that they help to delineate expectations within a particular field. They also aid in alleviating confusion when scientists from one field collaborate with those of another field.

It is also important that scientists discuss their responsibilities vis-à-vis colleagues, students, and professional institutions. There is a good deal of conflict and confusion among graduate students about what they can and should expect from their mentors. There is probably also some confusion on the part of mentors as to what they can and should ask from their students. Responsibilities for sharing information, for ensuring honesty of one’s co-authors, and for pursuing accusations of whistleblowing are often at issue for professionals. Which responsibilities should be shouldered by the institution and which by the individual researcher are valuable to discuss. Professor R from the second case scenario in Section 1 did benefit from discussion of responsibilities. It was clear from the comments around the table in the University Seminar that few of his colleagues agreed, as he had assumed, that he had a responsibility to ensure that his student be an author on a publication. And few believed, as he thought, that his behavior was an example of moral excellence. He didn’t promise to change his practice, but he did promise to think more about it.

One aspect of responsibility that is important to note is that all scientists have some responsibility for their actions. The tool that we used to evaluate student learning the first time we ran our graduate course pointed out to us that many students responded as though students in the test scenarios were victims who had little or no responsibility for their own actions. The students analyzed a case in which a postdoctoral fellow had misrepresented his data on a published graph. The students were able to identify the part played in the misadventure by a failure of responsibility on the part of the faculty advisor and the journal editors. Few held the postdoc primarily responsible for the misrepresentation, a point that had seemed clear to the faculty members who chose the case for analysis. The students preferred to blame shoddy training and poor mentoring for the postdoc’s misdeed. Each person in a laboratory, on a publication, and at a research institution has responsibilities to maintain the ethical integrity of the field, and it is important that these responsibilities be discussed and acknowledged by all practitioners in the lab: faculty, students, and technicians.

Examples of conventions and responsibilities point up a central advantage to discussions of ethics and research among scientists. Discussions of ethics force individuals to verbalize their positions on the issues. Verbalizing one’s position removes the opportunity for the sort of excuse used by Dr. Z in the first scenario in Section 1. Had Dr. Z been provided a forum to verbalize the fact that knowing the conventions of the field is central to making ethical decisions, then it would have been much more difficult for him to have claimed ignorance of such conventions. Allowing one’s positions to remain unstated makes it far easier to overlook obvious flaws in one’s own arguments.

Finally, ethics education can enable scientists to place their positions into a logical framework from which they can look for consistent approaches to related problems. In this sense it was the perspective of the Dartmouth team that the involvement of philosophers in both course design and teaching of research ethics is central to development of a course in this discipline. In contrast to the dismissive approach taken by some scientists, we believe that philosophers are essential in assisting scientists to define a realistic, rational ethical framework from which to view ethical problems. Just as a scientist would not try to develop a project in a related but different scientific field without collaboration with an expert in that scientific field, so developing a course in ethics without the benefit of ethicists is a naive endeavor.

Moral problems are not isolated from one another, and solutions to ethical problems in science cannot run counter to solutions to ethical problems outside of science. It cannot be moral for a scientist to deceive or to break a promise without justification any more than it is moral for a physician, an auto mechanic, or a secretary to do so. Because morality is a public system, our solutions to one problem have implications for others. Morality is a public system in that it is, at its fundamental level, a series of generally understood but rarely spoken rules about how we act in relation to one another. When Professor R in scenario 2 decided to give first authorship to his student, this decision had implications for all first authors. First authorship cannot mean both that an individual has had primary responsibility for conceiving of, developing, and performing a set of experiments and that this individual has not had this responsibility. Exceptions to the rule must themselves be publicly explicit to be moral.

Just as philosophy has been central to medical, engineering, and legal ethics, it is central to research ethics. A study of moral theory can help scientists to identify moral problems and differentiate these from legal, social, and economic problems. An approach centered in philosophical tradition will also help scientists clarify the value of making their positions and their arguments explicit. It will expose inconsistencies in the scientist's approach in dealing with ethical matters. On a problem-by-problem basis, a philosophical approach can assist scientists in separating actions that are morally neutral, and thus morally permitted, from those that involve responsibilities and are thus morally required, from those that are unacceptable and thus morally prohibited. Moral theory need not be learned in great detail, and it is not necessary to learn about the variety of moral theories that have become accepted as the "standard" theories. What is necessary is learning to approach moral problems in a systematic way.

We designed our graduate course with an eye toward those topics that we felt would provide the best foundation in ethical decision making. We began by reviewing the topics covered during two years of our University Seminar, and from these we chose those topics that we felt would be of the greatest value in conveying conventions and responsibilities to students at an early stage in their careers.

The content areas covered in the University Seminar included methodology, reporting research, professional honesty, research relationships and communication, institutional responses, conflict of interest, journalism and science, human and animal experimentation, and objectivity in science. From these we chose to concentrate in the graduate course on topics of immediate importance "at the bench": methodology, reporting research, institutional responsibility, peer review, human experimentation, and animal experimentation. We also included a session on interpersonal interactions in the lab. Issues of social responsibility, including such topics as "journalism and science" and "objectivity in science," were set aside.

Although the original target audience for our course was graduate students in biomedical sciences, we drew students from psychology, engineering, chemistry, and earth science. Students in different disciplines had different levels of interest for different topic areas. Students in psychology wanted more concentration on human experimentation; those in engineering wanted less. Students in engineering wanted more attention paid to business and commercial complications faced by scientists; those in psychology for the most part did not. Courses can be designed to focus greater or lesser attention on different content areas to serve different target audiences. Nevertheless, we do believe that a survey of certain major and essential content areas is an important part of each scientist's education. We see our course as a survey course that had the function of beginning the process of ethics education.

The disagreement between students from different disciplines about what ought to receive primary attention in the course was offset by the value of students coming to understand how conventions among scientific disciplines differ. While we initiated the faculty seminar to develop a teaching team and to practice thinking together about these issues, we discovered in the process of running both a University Seminar and a graduate course that the faculty were often more engaged in discussion of these issues than were the students. For this we credit the role of experience. Faculty with years of research behind them had endless stories and mishaps to relate. Some faculty also found themselves defending actions that students dismissed offhand as morally prohibited. Students tended to be somewhat idealistic and unrealistic about the pressures and the temptations to which they might someday succumb. As we discuss in Section 4, we believe that faculty seminars are central training grounds for faculty involvement in ethics education.

It should not be forgotten that faculty can also learn from students. In discussions with Professor R, none of the faculty identified the responsibilities of the student to whom the gift authorship was given. When we brought this same case to a group of students, one said that he would not accept authorship in this case because he would not want to assume responsibility for data he had not collected himself.

The course that we developed was targeted for graduate students, but we feel that it could be used with some modifications for researchers at all stages of their careers. Because ethics education involves the development of complex skills more than the incorporation of empirical information, the study of ethics and its practical applications can and should be a process that continues throughout one's career. The course that we outline in the next section can only begin this process.

A Course in Research Ethics

Our course in scientific research ethics had a seminar format in which class sessions were built around analysis of real and hypothetical cases. As described in the previous section, our overall goal for the course was to assist students in bringing a systematic methodology to ethical problems. We expected students to develop an understanding of what it means to work at ethical problems in a systematic fashion. Our approach to teaching was, therefore, to use structured discussion of cases as the central feature of class sessions.

Students met for a single two-hour session once a week during a nine-week term. Each class session focused on a specific topic area. The course was team taught with each class session lead by one faculty discussion leader. Several members of our faculty teaching team were present at all times to answer questions and engage in discussion with students.¹ The course director was present for all sessions to provide continuity. An essential component to team teaching in this manner was for course faculty to spend considerable time working together on issues of research ethics, a process described in the next section.

Students were assigned readings in advance of each class session to help them become familiar with regulations, conventions, and responsibilities within the topic areas. We expected students to use this information in discussion when they came to class. Although we began by thinking that some formal lectures would be helpful for students, we changed our minds after weighing the result of both the students' comments and our own assessment of what the students had learned the first time we offered the course. Our experience leads us to be skeptical of using valuable class time for the presentation of material that the students can incorporate through readings. We do, however, believe in creating class discussions that require students to draw upon this information whenever possible. What we found was similar to what has been suggested by other teachers of ethics: that passive learning, simply listening to lectures, does not adequately equip students to use their own judgment in analyzing real-life situations.²

We recommend that the first session of the class be used to present a framework for dealing with ethical problems. The first time we offered the course, we did not have such a session. This was partly because we were concerned that science students would be turned off by a blunt discussion of ethics. We hoped instead that students would recognize the ethical theory behind our discussion of the cases. This did not work. The students did not adequately develop a systematic approach to ethics. The second time we offered the course, we presented a session on ethical framework at the start, and we were able to relate all further discussion back to the material presented in the first session; this was a far more successful approach.

Real cases, documented in newspaper and other articles, were an important source of course materials. We believe that real cases bring a depth and reality to the discussions. We thus began our course with the discussion of a real and very complex case, the Imanishi-Kari/Baltimore case. In addition, we used a combination of case scenarios and literature to focus on issues that could less easily be deciphered from the real life situations. The play **A Stampede of Zebras** by R. G. Martin, for example, was very important in helping us present the topic of interpersonal interaction in the laboratory.

As cases highlight what has gone wrong, we were concerned that the use of case material might leave students with a negative view of the field they are entering. But, in our experience, students appreciated the use of case material, particularly when cases were well chosen so that the situations were familiar and believable. Rather than making students uncomfortable with their chosen field, the use of cases reassured them that they were not alone with, and unusual in, concerns that they themselves had recognized or confronted.

To reinforce the case analysis method, we included one session for student presentations. During this session students presented and analyzed cases of interest to them. We believe that student presentations are a central component to an ethics course. Although we had the students do these analyses through verbal presentations, we would have preferred to also include written presentations. In fact, we feel that written assignments on a weekly basis would be optimal. Such a course structure would require, however, that a course in research ethics have more institutional support than we were able to muster. Since, as we describe in Section 6, recruitment of students was a problem for us, we intentionally kept the course requirements to a minimum.

What follows is a presentation of the course format and goals for our course in research ethics. Because the use of goals may be unfamiliar to many scientists (as they were to the scientists on our team) it deserves some explanation. Scientists are, for the most part, used to teaching in a lecture format. This is because in science courses we are presenting information based on data and statistics with the aim of increasing a student's body of knowledge. In ethics teaching, as described in previous sections, we are teaching a process, a way of thinking through a problem, and are less concerned with teaching a body of knowledge. Making use of course goals is therefore essential. This is because teaching through case analysis involves far more than simply presenting the case and waiting for the students to say something about it. A successful discussion leader must center the discussion around a set of goals as the case unfolds. At the end of the class session a successful discussion leader will have related the case to each of the goals and drawn the students into analysis on a number of points related to the goals. In this way discussion of the case will have proceeded, not as a random and fruitless exercise, but rather, as a forum for instruction in the issues of central importance to the course. Teaching through case analysis requires a great deal of time, attention, and planning. Crucial to teaching via case discussion is identification of the goals for each session.

COURSE GOALS AND PLAN

Course Format:

This team-taught course will use a case-based format. Instructors will plan presentations around cases (either real cases or case scenarios). The goal is to encourage students to participate actively in discussion of issues. Faculty presentations will be brief, no more than 10 minutes in length. The role of the faculty is to present the complexities of the case; to briefly clarify relevant guidelines and regulations where appropriate; and to relate the responses of the students to the moral rules and to the concepts of morally prohibited, required, permitted, and encouraged behaviors.

Course Goals:

We are offering this course in the hopes that students will:

1. Be able to clearly describe relevant scientific conventions including laboratory practice, institutional responsibility, etc.;
2. Be able to describe what leads to ethical problems including causes inherent in the social context of the practice of science;
3. Be able to consider how to bring current scientific conventions more in line with the ideal;
4. Be able to separate behaviors into four categories: morally prohibited, required, permitted, and encouraged, thus illustrating an understanding of the role of the scientist in society.

Week 1: Ethics: A Framework for Dealing with Ethical Problems in Research

Format:

The class will discuss the article "Moral Theory and Science"

Objectives (students will be able to):

1. Understand basic concepts that underlie ordinary morality;
2. Understand that ordinary morality applies to scientific practice.

Week 2: Methodology and Reporting

Format:

This class will be based on the Imanishi-Kari/Baltimore case. There will be a brief synopsis of the case followed by a case discussion. Specific issues related to methodology and reporting will be highlighted. Other aspects of the case will be discussed if time permits.

Objectives (students will be able to):

1. Describe how ethical behavior is entirely consistent with, and necessary for, good scientific methodology and reporting;
2. Explain what each of the following is and why they constitute scientific misconduct: falsification, fabrication, plagiarism;
3. Explain the scientific and ethical justification behind each of the following scientific conventions:
 - a. Keep good notebooks
 - b. Use statistics appropriately
 - c. Repeat experiments until you are confident of the result
 - d. Record and report your work accurately;
4. Explain the difference between hiding negative results and morally permitted omission of an experiment that doesn't work;
5. Explain what should be included in the "Methods" section of a paper. Articulate the ethical justification of why this material needs to be included;
6. Discuss the validity of the assumption that erroneous results will be "caught" through replication of the data in other laboratories;
7. Explain the importance of adequately citing previous work in the field.

Week 3: Interpersonal Relationships**Format:**

This class will be based on the play *A Stampede of Zebras*. A brief discussion of the roles and responsibilities of laboratory personnel will be followed by discussion of the interpersonal issues raised in the play.

Objectives (students will be able to):

1. Explain the relationship between lab hierarchy and the success of the work and between group dynamics and the success of the work;
2. Describe what constitutes judicious (permitted, encouraged, etc.) use of power within the lab structure and provide examples for how power can be used and misused;
3. Describe professional limits on nonprofessional relationships involving lab personnel;
4. Describe loyalties to mentors, other colleagues, and friends and explain how these can give rise to ethical problems;
5. Understand the way in which loyalties to colleagues and friends can lead to difficulties in regard to making appropriate ethical judgments.

Week 4: Practical Applications in Reporting and Peer Review**Format:**

This session will involve discussions about a set of short case scenarios. The class will be divided into small groups for the initial discussions of the cases. Groups will be brought back together at the end to review and summarize the issues discussed in each group.

Objectives (students will be able to):

1. Explain how ethical issues arise around conventions of authorship: for example, the order of listing of the authors and who to include (and exclude) as an author on a publication;
2. Explain the conflicts of interest that can arise from the peer review system;
3. Describe the responsibilities of reviewers of publications and grants;
4. Describe relative merits and failings of alternative systems of evaluation (i.e., non-peer review).

Week 5: Institutional Responsibility/The Whistleblower

Format:

This class session will begin with a discussion of the difficulties encountered by whistleblowers. Using a hypothetical case scenario, students will develop their perspective on how they perceive an institution might best respond to accusations of misconduct. The second half of the class will rely on examples from cases that will explore the issues from the perspective of the institution.

Objectives (students will be able to):

1. Explain institutional and governmental regulations (including biosafety regulations) and policies (including policies on misconduct) relating to the practice of scientific research;
2. Provide examples of alternative methods of dealing with misconduct (this should be done from the point of view of a student, PI, department head, or dean);
3. Describe the responsibilities of institutions in the ethics training of graduate students and postdocs;
4. Describe the responsibilities of the institution for enforcing institutional and governmental regulations;
5. Describe the relevant rules and regulations including institutional conflict of interest policy.

Week 6: Scientists' Relationships with Funding Sources

Format:

In this class session students will deal with issues of conflict of interest in several different cases involving funding sources.

Objectives (students will be able to):

1. Describe the obligations of students and faculty to funding sources (funding sources may include commercial, governmental, military, etc.);
2. Describe the potential conflicts that can arise between obligations to funding agencies or employers and obligations to scientific integrity;
3. Differentiate between enthusiastic and exaggerated grant proposals;
4. Describe the relevant rules and regulations including institutional conflict of interest policy.

Week 7: Animal Research

Format:

The class will begin with a discussion of the moral status of animals. The students will then be divided into small groups where they will review research proposals as though they were members of an Institutional Animal Care and Use Committee (IACUC). At the end of class the findings of each group will be reviewed by all.

Objectives (students will be able to):

1. Explain the purpose of the relevant rules and regulations relating to the use of animals in research;
2. List the ethical concerns posed by the use of nonhuman animals;
3. Develop guidelines for evaluating the appropriateness of using animals in a research project;
4. Explain the role and responsibilities of the scientist and of the IACUC in the protection of research animals.

Week 8: Human Research

Format:

Students will review two complex cases on human experimentation. Issues of responsibility of the investigators and the Institutional Review Board (IRB) will be discussed.

Objectives (students will be able to):

1. Explain the purpose of the relevant rules and regulations relating to the use of human subjects in research;
2. List and explain the criteria of valid consent; understand the moral significance of obtaining valid consent;
3. Describe principles relevant to moving from basic experimental research into clinical trials (e.g., when is one ready to do this?);
4. Explain the role and responsibilities of the scientist and of the IRB in the protection of human subjects;
5. Understand the responsibilities of the PI, as well as clinical and nonclinical collaborators, for ensuring that obligations to IRB requirements are met.

Week 9: Student Presentations

Format:

Students will work in groups to present a case or case scenario of interest to them. Their presentations will include defining the ethical issues raised by the case and evaluating the actions taken. Faculty will participate in the discussions and assist the students to understand aspects of the case that they may have missed.

Objectives:

To give the students an opportunity to use the skills developed during the term.

Notes

1. The availability of faculty for attendance at numerous class sessions was a luxury afforded us by the fact that the course was taught under grant funding. Even a team-taught course will not always have

this luxury without such funding. In this case we would recommend that a single course director be available for every session and that the total number of faculty not exceed three.

2. E. P. Learned, "Reflections of a case method teacher." In **Teaching and the Case Method**, ed. C. R. Christensen, vol. 87, 9–15 (Cambridge, Mass.: Harvard Business School, 1981).

Training Faculty to Teach Research Ethics

Before we taught a course for graduate students, we had to learn the field of research ethics ourselves. We then had to develop our skills as teachers of this field. The learning process that we engaged in took several forms: We sought out and studied the cases and case material in the field; we spent time ensuring that the scientists gained an understanding of ethical theory and that the philosophers gained an understanding of scientific practices; and we developed our abilities in applying ethical theory to cases in research ethics. This work was done within the University Seminar series discussed earlier, within a Moral Theory Study Group, and within a series of meetings of the faculty teaching team called Core Group Meetings. The final development of the faculty as teachers of research ethics came through teaching the graduate course itself.

The role of the University Seminar in faculty training was alluded to in Sections 1 and 2. The University Seminar was a testing ground for material. Cases were explored and discussed, issues were raised and evaluated, and topic areas were sorted and reviewed. The University Seminar gave both faculty who were teachers in the course and those who were simply interested in the subject (about 40 participants) a forum for discussion. It gave a wide range of faculty from different scientific disciplines a chance to express their opinions about cases and issues. An essential aspect of this forum for the course itself was that when material was presented in class in front of the students, faculty were not hearing it for the first time. In this way differences of opinion between faculty members were "hashed out" prior to class sessions. We strongly recommend that anyone planning a course in research ethics, particularly those planning to team teach, participate in a series of seminars or informal study groups prior to bringing the material to students.

The Moral Theory Study Group involved only the faculty teaching team (six members). This study group began by dealing with ethical theory as an issue separate from the ethics of scientific research. Moral theory was then systematically applied to specific cases, simple ones at first, and more complex ones later.

Core Group Meetings allowed us to bring in additional material that fit into neither of these contexts. Ethicists learned more about the nature of bench research. All of us learned something about the history of science and the development of present-day scientific conventions.

A central feature of all of our faculty training sessions was intense and emotional debate (some might call this argument). Some of this debate was in fun, some was soul searching, some was fiercely self-protective, and all was loud. Scientist to scientist, we actively debated the conventions of the field. The value of this for the subsequent course was that it allowed us to gain a thorough appreciation of the extent of the differences in conventions from one area of science to another. Scientist to ethicist, we had our most intense, difficult, and possibly our most productive debates.

Talking about the ethics of any field is difficult. Ethics interferes with unbridled self-interest and arrogated power. This is as true in the professions as it is in the kindergarten room, and possibly no less uncomfortable for adults than it is for children. Discomfort is as evident among scientists as it is anywhere else. As one member of the science faculty put it, “It is harder than I thought to deal with issues of scientific integrity with scientists. They¹ tend to get defensive, feisty, and see ethics teaching as a peripheral activity.”

It would be wrong to conclude that debates at these meetings took the form of ethicists trying to tell scientists how to do science (although we occasionally did come close to this). Instead, the central feature of the debates was that they became learning experiences for all. One example of this can be found in an argument that developed over the topic of scientific methodology. Through a series of long and tortuous discussions spanning several years, our group struggled with the issues of how ethical theory applies to the scientific method itself. Through these discussions scientists learned to apply concepts of deception, cheating, and the need to have adequate justification before engaging in such activities, to the practice of science. Philosophers learned about fundamental distinctions in scientific research, such as the difference between a failed experiment—one that yields no data—and an experiment that produces a negative result—a result that contradicts one’s hypothesis. Through debate we came to what now seems an absurdly obvious conclusion, that a central feature of good scientific method is the ethical practice of science. However, we came to this conclusion with a heightened understanding on all sides of why this is so and why important features of both ethics and science make it so.

One reason for some of the tension between scientist and ethicist may have been the inherent conflict between the methods of science and the methods of ethics. According to one ethicist, scientists seem to have a “desperate hold on empiricism,” a need to rely on objectivity, and falsifiability in ethical as well as in scientific problems. Scientists, for their part, felt that ethics questions could be answered simply by applying the methods of science, and that in this sense there was “no separate domain of ethics” within the field of scientific research. The methods of science and ethics are different enough that the scientific reliance on objectivity can lead to confusion. Solving an ethical problem does require that you discover the facts of the case (e.g., who did what to whom and when). But solving such problems cannot wait for verifiable data on whether or not a particular course of action will lead to a desired conclusion. Indeed, ethics problems often have at their core the need for an immediate answer on an issue about which there is a central unknown. An example that relates back to the question of methodology is that the answer to whether or not a particular hypothesis is right or wrong cannot be a determining factor in whether or not a researcher includes or excludes a certain piece of data in a graph. The ethical determination on the use of that data must be made before we know (if we ever do) whether or not the hypothesis is correct. Some scientists will recognize that this particular example is also an example in which doing ethical science and doing good science coincide.

Learning to be teachers in this field proved to be a challenge above and beyond learning about the field of research ethics. After a year and a half of working together we offered our graduate course for the first time. Our plan in the first year was to present a small portion of the material in lecture format and to then move on to case analysis in the second half of each class session. We found the faculty resistance to this to be quite intense. Science faculty clung to the more familiar framework of lecturing the students. Cases were presented in lecture format. Regulations were laboriously described. “Discussions” were, in many instances, less discussions than presentations by sage scientists telling war stories and informing novices of how it **should** be. It was interesting that although we had worked together to use interactive approaches for a year and a half, it was still difficult for each of us to shed the familiar role of lecturers and to take on the role of discussion leaders. What we found was a marked distinction between the development of the skills in ourselves and the use of those skills in our teaching.

In the second year we were more successful. With a bit more prodding and a clear message from the students that they too would prefer more discussion, we pushed ourselves to use the skills in case analysis that we had developed. We insisted that faculty plan their presentations **without** a defined lecture component. We developed additional strategies, such as breaking into small groups, to ensure that we would not lapse into lectures.

Those of us who learned the ethics of scientific research as graduate students learning from a mentor or series of mentors did not have the opportunity to combine the skills of the scientist with the skills of the ethicist. When confronted with ethical problems, this leaves us searching for answers for each case as though it is isolated from all other cases. In this sense we have not been trained to teach a course in ethics to graduate students. The process that we undertook to develop our skills in this area was a difficult but a valuable one. We recommend it both for the benefit of the faculty and for that of the students they plan to teach.

Note

1. Given that this was said by a member of the science faculty, it is interesting that the individual said “they” rather than “we.”

Evaluating the Success of an Ethics Course

The Dartmouth team found that showing we had accomplished what we set out to accomplish in the ethics course was far more difficult than we had expected. All professors and mentors learn to trust their “gut” in determining when students have “gotten it.” And, in evaluating students’ acquisition of a new piece of knowledge, the professor’s instinct may be adequate, at least in the short run. But our ethics course focused on students learning concepts and a method for analysis rather than on pieces of information. It was only after teaching the course for two years that we felt that we had really learned how to adequately evaluate our students’ success in the course.

Adequate evaluation of an ethics course depends on the faculty accomplishing the following: clear articulation of reasonable course objectives; creation of a learning environment in which achieving the course objectives is possible; practice for students throughout the term in achieving course objectives; and creation of a vehicle by which students can demonstrate mastery of course objectives.

This list of necessary conditions for adequate evaluation is true for every course, but deserves special attention in the teaching of ethics. While there are those scientists who doubt that ethics can be taught, there are even more skeptics in and out of science who doubt the ability to measure what one has accomplished in the ethics class.

We blame evaluative skepticism on the confusion in the field that comes about when one fails to distinguish between pedagogical hope and instructional objectives. One might hope that one’s students become highly ethical practitioners in their careers and become highly ethical people in their private and public lives as well. But that is not an instructional objective.

A literature professor might hope that his students all become writers of fine literature, and a science professor might hope that her students make significant advances in knowledge through their future work. These are the pedagogical hopes that one may have for one’s students.

But whatever the pedagogical hope of the individual instructor, it is the instructional objective that provides quantifiable criteria for whether the instruction in a particular course has been successful or not. Instructional objectives articulate specifically what the instructor hopes to accomplish in the course. Whatever we might hope about the future ethics of our students, their moral righteousness is not a legitimate course goal. It is, therefore, not an instructional objective that can be adequately evaluated at the end of the term.

Our course goals, and the specific goals for each class that amplified course goals, were presented in Section 3. These goals included objectives that we wished the students to achieve. The goals also implicitly detail the steps of moral analysis that we wished the students to learn. These steps in moral analysis include:

1. Describe the action(s) that raises an ethical question.
2. Determine whether the action conflicts with relevant scientific conventions.
3. Articulate any relevant social or professional responsibilities that the actor has in the situation.
4. Discuss what kinds of alternative actions would be morally prohibited and why they would not be acceptable.
5. Identify a series of alternative actions that would be morally permitted in the specific case and discuss why they would be acceptable.
6. Identify which actions would be morally encouraged in the specific case and discuss why certain actions are better than others.

The course goals or instructional objectives provide a basis for developing an instrument that allows students to show that they have learned new skills and have acquired a more sophisticated understanding of the profession. There is no better way to determine a lack of clarity in goals than by asking how you would test to see if students had achieved these goals.

Creation of an adequate learning environment is central to the teaching of ethics. The learning environment refers to the emotional and intellectual climate in which the students are expected to learn ethics. We found that it was important to evaluate how much students are encouraged to take the kind of intellectual risk necessary to express their beliefs and to try on new ways of looking at an issue.

Many of us, in the first year of teaching the course, fell into the familiar trap of sharing information rather than facilitating learning. In our eagerness to share understandings and information with the student, we forgot that student learning in the ethics classroom, like the lab, is dependent upon student practice with all of its fumbling and failures.

This lack of understanding of the learning process is particularly significant, for no one on the team learned from being lectured to by their scientific or philosophical peers. We had forgotten the joyful arguments we had as we individually struggled to get clear on conventions, to decide what made a particular action right or not, and to become more consistent in our attempts to generalize from particular actions to standards for the scientific community.

Formalized surveys exist for determining the level of safety and challenge that students perceive in the classroom (H. Stone; R. Moos and P. Insel; R. Mitchell¹). But we found that this could be adequately determined informally by noting the students' willingness to participate in discussion and their willingness to challenge or question the beliefs expressed by the instructor. The traditional student evaluation form completed at the end of the class also makes clear, as it did to us in our first year, if the professor is using too much class time for "preaching" rather than teaching.

An additional tool that we attempted to use to measure the learning environment was developed by William Moore from the Center for the Study of Intellectual Development. In a precourse instrument we asked the students questions that allowed us to assess their learning style preferences. In a postcourse instrument we measured the students' perceptions of how well the environment fit their needs with regard to abstraction, personal relationships (personalism), structure, and diversity. Our experience with this test has been outlined by us elsewhere.² In summary, time costs for the tests (one hour each to complete the pre- and posttest) left us unpersuaded about the worth of this test.

We believe that student practice is of central importance in developing skill in moral analysis. Students can practice in a variety of ways: large-group discussion, small-group work on problems or scenarios, individual case write-ups or journals. In retrospect, we did a better job in the second year than in the first in providing opportunities, in every class session, for group discussion and work. However, because of colleagues' concern that the elective ethics course might take too much time and attention away from other graduate work, we felt unable to assign weekly writing assignments. We believe that the best way to give students practice in analyzing ethical questions in science is to provide a combination of peer discussion and individual written analysis each week.

It seemed clear to us that the appropriate way to evaluate the students' ability to analyze moral problems in science was to give them such problems for analysis. A pretest/posttest combination provided an opportunity for students to show new or greater understandings at the end of the term as compared with an analysis completed at the beginning of the term.

After two years of teaching the course and of trying out the vehicle in other settings,³ we have concluded that a pretest/posttest evaluation vehicle works if the following criteria are met: Students are motivated to take the vehicle seriously; the special perspective of students in the lab is taken into account in deciding the content for analysis; and students are asked to perform a meta-analysis at the end of the term rather than simply reanalyzing the case that they considered at the beginning of the term. Meta-analysis involves asking the students to consider the inadequacy of their own previous analysis of the case.

In the first year that we taught the course, students received the grade of “Pass” for attending the seminars and for completing the pretest and posttest materials. This did not encourage them to take the writing assignment seriously. The faculty was extremely dissatisfied with the scoring and evaluation of student performance as determined by outside readers. At first, we wondered how the scoring could have been so inadequate. It was only after we had the pretest and posttest essays coded and distributed among us that we realized that we could not tell on the basis of response which were pretests and which were posttests. While we recognize a number of factors contributing to the students’ poor performance (such as our reliance on lecture), it was clear to us that the students completed the analyses hastily.

One of us (D.E.) has also found that students do a far more complete job of analysis, both early and late in the term, if the vehicle is given at the beginning and end of the term as a take-home rather than in-class assignment. The results are also far easier to read.

The content for the analysis is also important. In the first year, we chose a case⁴ that we believed would engage the students. As two postdocs had participated in the reported misconduct in the case, we believed that the students would be able to see themselves in a similar situation, facing similar temptations. We expected their later, more sophisticated analysis to go beyond the obvious problem of the postdocs’ falsification and fabrication and that they would be able to identify the need and limits of responsibilities of others in the lab and of the institution as a whole.

Instead, we found that the students identified with the postdocs’ lack of power in the situation and could not get beyond this. While the faculty enthusiastically endorsed this case because of the clarity of the problem in terms of individual researchers and subtlety of the institutional issues, some of the students perceived the postdocs only as victims. One student wrote, “I feel for the student because his advisor or mentor should have been there to help in constructing and checking the figures.” Another wrote, “In both cases, some fault should be found with the researcher in charge of the lab . . . Was he putting undue pressure on these students to publish?” Yet another said that the postdoc’s problems “stem from his inadequate training.”

Our first attempt at pretest/posttest analysis was to give students instructions for the posttest that were identical to those given for the pretest. That is, for both the pretest and posttest, we gave the following instructions: (1) Identify what you see as the ethical problems in this case. (2) Discuss what the individuals involved did right. (3) Discuss what the individuals involved could have done or should have done differently.

As we analyzed our failure to uncover a significant difference in the students’ pretest and posttest analysis, we speculated that boredom was a factor. Students approached the posttest problem with a “been there, done that” attitude. From their perspective, analyzing the same problem that they had analyzed 10 weeks earlier was a waste of time. Our hunch was validated by consensus on the student evaluation forms that the content of the course was “easy to understand.” Although they enjoyed the class, students did not perceive themselves as learning anything new.

We also realized that as much as the faculty wanted to see improvement in how students approached ethical problems at the end of the term, we also were interested to see whether students perceived any change in themselves. It seemed to us that part of learning ethics is the student's ability to bring to consciousness patterns of thinking through problems, whether adequate or flawed. The student's ability to perceive change in how he or she thought about an ethical problem was at least as important as any change that we perceived.

The posttest instructions used in the second year reflected the faculty's new understandings. Students were specifically asked not to repeat their initial analysis, but to evaluate the adequacy of their initial analysis. In addition, students were given the posttest as a "final exam." The posttest instructions read as follows:

The purpose of this final exam is to help assess the influence this class has had on the way in which you analyze ethical problems in the practice of science.

The diagnostic test that you completed at the beginning of the term is attached.

1. Please review the case, the instructions you received at the beginning of the term and your responses.

2. Analyze your initial response. Describe how your thinking has changed. Be sure to discuss understandings or information that you have now that you didn't have at the beginning of the term.

This is your opportunity to consider how your thinking has changed. Please notice changes in how you think as well as any changes in what you think. It may be that you reach the same conclusion now that you did in the beginning of the term, but that you think about the situation in a different way.

3. Please attach your diagnostic test to the final exam.

Please keep in mind that you are not being asked to repeat the assignment from the beginning of the term. You are being asked to analyze how you initially responded to that assignment.

The results of this posttest showed changes in student performance not seen on the previous posttest. The students' meta-analyses did include recognition of patterns and generalizations—all necessary components for performing systematic moral analysis. In addition, they were able to reflect on their earlier attempts at analysis:

- "All in all there are more options available and more ramifications involved in this scenario than I had originally considered."
- "I think my original response to this scenario is too simplistic."
- "I think that my original inspection of the first perspective was too sophomoric."
- "In addition to the arguments previously offered I would add the 'would you want everyone to do this?' test."

These students were clear that they had made gains through the course.

1. H. Stone, "Preferred learning styles index," personal communication, University of Wisconsin Medical School; R. Moose and P. Insel, "Preliminary manual for the work environment scale" (Palo Alto, Calif.: Consulting Psychologists Press, 1974); R. Mitchell, "The development of the cognitive behavior survey to assess medical students' learning," paper presented at the Annual Meeting of the American Education Research Association, San Francisco, April 22, 1992; bibliography from G. T. Moore, S. Block, C. Briggs-Style, and M. Rudolph, "An evaluation of the impact of the new Pathway curriculum on Harvard Medical Students," personal communication.

2. D. Elliott and J. E. Stern, "Evaluating teaching and students' learning of academic research ethics," *Science and Engineering Ethics Journal* 2 (3, 1996).

3. One of us (D.E.) used and continues to use a pretest/posttest vehicle as described here in her teaching of an introductory-level ethics course, as well as an upper-level seminar in ethics and public affairs, and in graduate-level seminars on special topics in ethics at the University of Montana. Our experiences with this tool are detailed in another publication (see note 2).

4. The case we used was a real case that occurred at Cal Tech. The case is outlined in an article, L. Roberts, "Misconduct Caltech's trial by fire," *Science* 20 (September 1991):1344-47. The students were given a modified version of this reference that omitted some of the editorial comments found in the original article.

Concluding Remarks

It is hard to find someone who would admit to being against ethics. But it's equally hard to find faculty in academic departments of science and engineering who are willing to give up precious graduate time and credits for formal instruction in ethics.

A survey published in the March 1989 issue of the *Council of Graduate Schools Communicator* showed that more than one third of the 259 deans responding believed that their school's performance was "not very effective" or "not at all effective" in preparing graduate students to deal with ethical issues in their profession. "Overall, 40% report that their schools have no expectations about ethics in the curriculum; . . . 56% of the most heavily funded universities have neither informal expectations nor written policies."¹

Our experience was consistent with this study. We had strong support for the seminar at the Graduate Dean level. We had strong interest from a handful of faculty across disciplines. We had students eager to engage in discussions concerning matters of ethics in research. But when it came down to scheduling students to take a term-long, two-hour-per-week seminar, most faculty, even faculty for the course itself, didn't encourage their students to sign up, saying that they could not justify the time and energy that the course was perceived to take away from the students' "main graduate school mission." The students were unwilling to commit to the course without their mentors' support. And the Graduate Dean could only suggest, not demand, that departments recommend the course.

Federal mandates that students on training grants be taught ethics encourage schools to do **something**, but that something is far more likely to resemble a two-hour session in platitudes and warnings or a lecture course in the conventions of science, than a 20-hour course that includes formalized training in ethics. Discussions with teachers of ethics in science at other centers indicates that many use perks (or bribes), such as serving lunch to students, to induce them to take ethics seminars. Such perks may help increase student attendance, but they will not help students become serious about the importance of studying ethics.

In some disciplines, such as medicine, the study of ethics has gained in importance in recent decades. Although an initial reason for this was probably an increase in litigation, the desire for education in medical ethics has taken on increased importance in the minds of many students and practitioners. Formal training in clinical ethics is now the rule rather than the exception in medical education. Ethics committees are now standard in most hospitals. Forums for discussion of ethical problems are common in medical settings. This type of interest in ethics will only occur in science if and when faculty become serious about the subject. It will only occur when faculty see the training of their students in ethics as an important part of their responsibility as mentors rather than as a threat to their security as authority figures. Finally, ethics will only become a standard part of graduate education when it becomes an established part of the graduate school curriculum. We hope that this will occur at most institutions before the numbers of misconduct cases make it a federally mandated necessity.

Note

1. J. P. Swazey, K. Seashore Louis, and M. S. Anderson, "University policies and ethical issues in research and graduate education: Highlights of the CGS Deans' Survey," *CGS Communicator* (3, 1989):1-3, 7-8.

Course Reading List

Following is the reading list that we used during the 1995 offering of our Ethics of Scientific Research course. Many of the articles cited can be found in the Reader that is published in conjunction with this book. The Reader also contains case scenarios of the type referred to in this reading list.

Week 1: Ethics: A Framework for Dealing with Ethical Problems in Research

Required Readings

1. Gert, B. "Morality and scientific research." Personal communication.

Week 2: Methodology and Reporting

Required Readings

1. Racker, E. "A view of misconduct in science." *Nature* 339:91–3. 1989.
2. Hilts, P. J. "The science mob." *The New Republic*. (May 18):25, 28–31. 1992.
3. Hamilton, D. P. "Verdict in sight in 'The Baltimore Case.'" *Science*. 251:1168–72. 1991.

Week 3: Interpersonal Relationships

Required Readings

1. Martin, R. G. *A Stampede of Zebras*. Washington, D.C. 1991.

Week 4: Practical Applications in Reporting and Peer Review

Required Readings

1. Committee on Science, Engineering and Public Policy. *On Being a Scientist: Responsible Conduct in Research*. Second edition. National Academy Press. Washington, D.C. 1995. Selected readings.
2. Bulger, R. E., E. Heitman, and S. J. Reiser. *The Ethical Dimensions of the Biological Sciences*. Cambridge University Press. Cambridge. 1993. Selected readings.
3. "Ethical Guidelines for Publications of Research." *Endocrinology*. 132:1–2. 1993.
4. Case scenarios.
5. Amato, I. "Rustum, Roy: PR is a better system than peer review." *Science*. 258:736. 1992.

Suggested Readings

1. McCutchen, C. W. "Peer review: Treacherous servant, disastrous master." *Technology Review*. (October):27–40. 1991.

Week 5: Institutional Responsibility

Required Readings

1. Taubes, G. "Misconduct: Views from the trenches." *Science*. 261:1108–11. 1993.

Week 6: Scientists' Relationship with Funding Sources

Required Readings

1. U.S. Department of Health & Human Services. *Office of Research Integrity Biennial Report 1991–92*. Public Health Service. Rockville, Md. (September). 1993.

Suggested Readings

1. Panel on Scientific Responsibility and the Conduct of Research. "Chapter 1: Introduction." In *Responsible Science: Ensuring the Integrity of the Research Process*. 22–31. National Academy Press. Washington D.C. 1993.
2. University of Illinois Board of Trustees. "How Many Shades of Grey." 4.13–4.16. 1992.

Week 7: Ethics in Animal Experimentation

Required Readings

1. Bennett, B. T. "Chapter 1: Regulations and requirements." In *Essentials for Animal Research: A Primer for Research Personnel*. 1–7. National Agriculture Library. Beltsville, Md. 1994.

2. Tannenbaum, J., and A. Rowan. "Rethinking the morality of animal research." *Hastings Center Report*. 15(5):32–43. 1985.
3. Dartmouth College Animal Care and Use Policy. Personal communication.
4. Dartmouth College Animal Subject Review Form. Personal communication.
5. Case scenarios.

Suggested Readings

1. Vance, R. P. "An introduction to the philosophical presuppositions of the animal liberation/rights movement." *Journal of the American Medical Association*. 268:1715–1719. 1992.
2. Remfry, J. "Ethical aspects of animal experimentation." In *Laboratory Animals: An Introduction for New Experimenters*, 5–21. A. A. Tuffery, ed. John Wiley & Sons. New York. 1987.
3. Caplan, A. L. "Beastly conduct: Ethical issues in animal experimentation." *Annals of the New York Academy of Sciences*. 406:159–69. 1983.

Week 8: Human Experimentation

Required Readings

1. "The Nuremberg Code." *Trials of War Criminals Before the Nuremberg Military Tribunals Under Control Council Law*. 10(2):181–82. U. S. Government Printing Office. Washington, D.C. 1949.
2. U.S. Department of Health and Human Services. "World Medical Association Declaration of Helsinki." In *Protecting Human Subjects: Institutional Review Board Guidebook*. (Appendix):A6-3 to A6-6. OPRR/NIH. Washington, D.C. 1993.
3. Department of Health, Education, and Welfare. "The Belmont Report: Ethical principles and guidelines for the protection of human subjects of research." *OPRR Reports*. (April 18). U.S. Government Printing Office. Washington, D.C. 1979.
4. Case scenarios.

Bibliography and Videography

Notes on the Bibliography and Videography

A wealth of books, articles, and videos are available for use in research ethics courses. References to the materials collected during development of our course in research ethics and the companion NSF grant can be found in the bibliographies and videography presented in the following pages. The references provide a basis for incorporation of a rich variety of material into a research ethics course. When used along with the reader that accompanies this monograph they provide the resources for further study on important cases and topic areas of interest. They also provide material for lively class discussion.

The bibliography is divided into three sections: a case bibliography, a topic bibliography, and an author index. The divisions can help readers locate material of interest for particular class sessions or can enable readers to search for material of known authors. Some of the articles, cases, and books span several different topic areas. Nevertheless, to avoid duplication, each article is cited in only one section of the case or topic bibliography. Those publications that incorporate more than a single topic area can be found in the General section of the topic bibliography.

The case bibliography presents lists of references on several of the more celebrated cases in research ethics. These cases encompass a number of different scientific disciplines and can be used to develop class sessions on a variety of different topic areas. Many of these cases are discussed and/or presented for consideration in abbreviated form in the Reader that is published in conjunction with this book. Material in the case bibliography can be used to supplement and extend a teacher's or student's understanding of the cases discussed in class.

The Challenger case is a complex case in engineering ethics that brings to the fore many issues concerning conflicts of interest and commitment. It is presented and discussed in Chapter 6 of the Reader. The Cold Fusion case is a case in the physical sciences that helps to develop issues in reporting of research and peer review. The Gallo case is a case in the biomedical sciences that brings up questions of interpersonal interactions and misappropriation of intellectual property. This case is used to introduce the topic of interpersonal interactions in Chapter 4 of the Reader. The cases in the bibliography on human radiation experiments provide illustrations of human experimentation protocols gone awry. An article that depicts differing perspectives on some of these experiments is presented for discussion in Chapter 9 of the Reader. One of the more complicated cases in research ethics, the Imanishi-Kari/Baltimore case, provides material for discussion of fabrication of research results, interpersonal interactions, institutional responsibility, and whistleblowing. This extraordinarily complex case concerns the alleged fabrication of research results in an immunology laboratory. Two of the references in the bibliography on this case are presented in Chapter 3 of the Reader, where they can be used to illustrate many of the topics expounded upon in the rest of that volume. The Milgram case is a case in psychological experimentation using human subjects. It is discussed briefly in the chapter on human experimentation, Chapter 9 of the Reader.

The final section of the case bibliography, Other Cases, contains a number of references to additional interesting, and often complex, cases. Many of these references are concise, well-written articles that can provide valuable examples for class discussion. Several of the cases, including Roberts's article on the Cal Tech case (1991), Marshall's article on the Michigan State project (1991), and Amato's article on Rustom Roy's decision to forgo peer review (1992), are contained in the Reader.

The topic bibliography is divided into sections that reflect our course outline. These topics include Methodology, Reporting, Funding and Peer Review, Institutional Responsibility, Whistleblowing, Animal Experimentation, and Human Experimentation. Added to that list are two important topic areas that, though not in our original course, were covered by the National Science Foundation (NSF) consortium. These topics are Teaching and Learning, and Conflict of Interest. We have also included a bibliography on engineering ethics, which should be particularly helpful to some audiences.

The General section of the topic bibliography includes material that does not fit neatly into any of the other case or topic areas. Included in this section are books of case scenarios such as the book by Koreman produced by the American Association of Medical Colleges and the book by R. L. Penslar of Indiana University. Also included are a novel by Carl Djerassi and a play by R. G. Martin. The play, **A Stampede of Zebras**, provides an excellent source of material for class discussion of issues related to interpersonal interaction. This play was released in the fall of 1996 as a video and as such is listed as well in the video index. Other books and articles present commentary, reviews, and case material.

Videos make an excellent contribution to a research ethics course. The videography provides a list of videos that can be used to spark discussion and illustrate issues. The videography presents videos along with a short description about the content of each. We also provide information on current prices and locations for purchase of the videos, although we caution that this information is subject to change.

The author index is provided to assist those readers who may wish to locate a publication by first author rather than topic. This bibliography contains the first author's name, year of publication, and the section in which the material can be found.

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Videography

Academic Integrity.

Produced and available at the Center for Applied Ethics, Duke University. Contact Aarne Vesilind (919) 660-5204. 1995. Cost: \$50.00.

- Individual vignettes dramatize situations in which students can be tempted to "color outside the lines." Cheating, whistle blowing, and other academic research dilemmas are skillfully enacted to stimulate discussion.

Biomedical Research: Is It Really Necessary?

Produced by Lockwood Films, London Canada. Available through Partners in Research (519) 433-7866. 1993. Cost: \$29.95.

- This 32-minute video is geared to the high-school audience. It is designed to answer the many questions and concerns expressed by this age group about biomedical research from a past, present, and future perspective and has received high acclaim from a widely based audience.

Burden of Knowledge: Moral Dilemmas in Prenatal Testing.

Produced by Wendy Conquest, Bob Drake, and Deni Elliott. Available through Direct Cinema, Ltd. (800) 525-0000. 1994. Cost: \$95.00.

- Prenatal testing has changed the experience of pregnancy, offering both greater certainty and the responsibility that comes with increased awareness. Speaking both to concerned consumers and to health care professionals, this film is a comprehensive primer on the standard procedures and the issues involved in this now common practice. Questions of what counts as appropriate test development are implicit.

Do Scientists Cheat?

Produced by NOVA. The film was subsequently carried by Films for the Humanities (800) 257-5126. It is no longer carried by any distributor. Written transcripts are available through Journal Graphics (800) 825-5746. 1988. Cost: \$5.00 for transcripts.

- A one-hour film that deals with the troubling question of scientific fraud. How prevalent is it? Who commits it? Can it undermine science and scientists?

Energy and Morality.

Produced by Bitterroot Films/Swain Wolfe. Available through Bullfrog Films (800) 543-3764. 1981. Cost: \$275.00 purchase/\$60.00 rental.

- A thought-provoking film that explores the complex relationship of energy use to different value systems. One predominant view is that living things tend to develop patterns that maximize their use of energy and that therefore in human societies it is economics that designs ethics. Another viewpoint, presented by Amory Lovins and E. F. Schumacher, is that ethics can, or should, redesign human economics to be in accord with nature's economy.

Ethical Issues in Professional Life.

Produced by the Carnegie Mellon University, Center for the Advancement of Applied Ethics. Available through Great Plains Network (800) 228-4630. 1996. Cost: Not determined.

- This set of 14 half-hour video segments is part of a program designed by the Center for the Advancement of Applied Ethics to provide students with an understanding of and a framework for analyzing the many ethical issues, problems, and dilemmas facing contemporary professionals. It addresses ethical issues and dilemmas of professionals in medicine, law, business, engineering, journalism, public administration, accounting, and the natural and the social sciences, among others.

Ethical Issues in Scientific Research.

Produced and made available through the Research Triangle Park Club of Sigma Xi. For information, contact Dr. Harvey Krasny, P.O. 13416, Research Triangle Park, NC 27709. To purchase a copy or a site license call (800) 768-4336 or (800) 269-7744. 1991. Cost: \$35.00.

- A one-hour video presenting a panel of scientists from academia, industry, and government who deal with ethical dilemmas of scientific issues such as authorship practices, peer review, data reporting, social responsibility of research, research fraud, and the role of the media in informing the public of scientific advances.

Gilbane Gold.

Produced and available through the National Society of Professional Engineers. Contact: Institute for Engineering Ethics (703) 684-2800. 1989. Cost: \$67.00.

- This dramatization was produced to stimulate discussions about engineering ethics in order to promote ethical conduct in the profession. It is exceptional in that the ethical dilemmas are well distributed between cast members as engineers, professors, business managers, journalists, and city officials. An outstanding teaching tool.

Medical Progress: A Miracle at Risk.

Produced and distributed by the Science & Technology Division of the American Medical Association. The video is part of a resource kit (800) 621-8335. 1992. Cost: Free.

- This video shows interviews with animal rights activists and scientists who use animals in research. It is produced by the American Medical Association, whose position is that many advances in medicine, both in the past and in the present, depend on the use of animals in research. Although the conclusion is biased by this position, the presentation demonstrates many of the arguments on each side.

Obedience.

Produced by Stanley Milgram. Available through Penn State Audio Visual Services, University Park, Pa. (814) 865-6314. 1969. Cost: \$310.00 purchase/\$35.00 rental.

- This is the classic Stanley Milgram research experiment, which spawned countless ethics discussions and textbook inclusions. It raises questions of deception of research subjects.

Protecting Human Subjects.

Produced and available through the National Institutes of Health and the Food & Drug Administration (301) 496-8101. 1985. Cost: Free.

- Three instructional films are collected on this one video. Topics covered are the development of today's programs to protect human subjects of research and how the needs came about, the criteria used by Institutional Review Boards in reviewing research plans, and the application of basic ethical principles in the actual conduct of human research. The three films are (1) Evolving Concerns, (2) the Belmont Report, and (3) Balancing Society's Mandates.

Scientific Research Integrity Video Series.

A project directed by Mark S. Frankel and Albert H. Teich, sponsored by the American Association for the Advancement of Science in cooperation with Amram Nowak Associates, Inc., Producer and The Medical College of Georgia, Division of Health Communication. The set of five tapes and discussion and resource guide are available through AAAS (202) 326-6600. 1996. Cost: \$79.95 (discount for AAAS members).

- Five short (7-9 minute) dramatized vignettes raise realistic issues in laboratory research ethics. Each vignette is complex, subtly raising a selection of ethical issues that are faced by individuals and institutions that engage in research. The Discussion and Research Guide provides a thoughtful synopsis of issues raised in each vignette and a series of questions sure to generate lively discussion among those interested in the responsible conduct of research. The Guide also includes a bibliography of materials relating to science and to ethics pedagogy.

60 Minutes—Challenger

Aired 1/21/96. Manufactured by Ambrose Video Publishers, Inc. Distributed by CBS-60 Minutes (800)848-3256. 1996. Cost: \$33.90.

- This segment of “60 Minutes” reviews the 1986 Challenger Disaster in which school teacher Christa McAuliffe and six astronauts lost their lives. The video focuses on the recollections and concerns of the families of the victims. In addition it introduces the audience to the issues raised by two engineers who attempted to report on the faulty O-rings. The details of the interaction between these whistleblowers and the management of Morton Thiokol and NASA are not explored in depth, but the segment does provide an introduction to the case.

60 Minutes—Michael Carey, MD.

Aired 1/24/93. Manufactured by Ambrose Video Publishers, Inc. Distributed by CBS-60 Minutes (800)848-3256. 1993. Cost: \$33.90.

- This segment of “60 Minutes” focuses on Dr. Michael Carey, a physician whose research involves neurologic injury to cats, and the targeting of his research by animal rights activists.

60 Minutes—Who Poisoned MaryAnn?

Aired 12/10/95. Manufactured by Ambrose Video Publishers, Inc. Distributed by CBS-60 Minutes (800)848-3256. 1995. Cost: \$33.90.

- This “60 Minutes” segment reviews the case of radiation poisoning of a young, pregnant scientist working at the National Institutes of Health. Issues related to the regulation and handling of radioactive materials are discussed. Interpersonal conflicts within laboratories are also addressed.

A Stampede of Zebras.

Under production at the Center for Applied Ethics, Duke University, under a grant from the National Science Foundation. Cosponsored by the Ethics Institute at Dartmouth College. Contact Arne Vesilind (at Duke) (919) 660-5204. 1996. Cost: Not determined.

- A video production of the play written by Robert G. Martin, which depicts the unfolding of complex ethical dilemmas in a research laboratory setting. Rich with issues of interpersonal relationships, research methodology and reporting, and institutional responsibility.

Susceptible to Kindness.

Produced by Larry I. Palmer. Available through Cornell University (607) 255-2090. 1994. Cost: \$98.95.

- Ethical issues from the Tuskegee Study of Untreated Syphilis in the Negro Male (1932–1972) are presented through excerpts from David Feldshuh’s play, Miss Evers’ Boys, and comments by nurses, physicians, government officials, James Jones, the author of **Bad Blood**, and others. In choosing the commentators, more than one side of the issue has been presented, so the experts are seen to disagree. A multidisciplinary approach to ethics. Raises questions of paternalism and consent in human research.

Trigger Films on College Teaching, Series E: Issues of Values and Ethics.

Produced and available through the University of Kentucky, Office of Media Design & Production (606) 257-8474. 1993. Cost: \$75.00.

- A collection of four short triggers that gives the audience the opportunity to consider the responsibilities of college professors in terms of fairness, the aims of education, determining grades, and the student-teacher relationship.

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