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 government[6] and individual institutions[7] 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.

2

Who Needs Research Ethics?

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 is 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.

3

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 may 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 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).

4

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. They[1] 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.”

5

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. Mitchell[1]). 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 case[4] 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.

6

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. Deptartment 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 Rustum 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.

Case Bibliography

Challenger

"Astronauts express opinions on shuttle launch safety." *Aviation Week and Space Technology*. (March 17). 1986.

"Morton Thiokol engineers testify NASA rejected warnings on launch." *Aviation Week and Space Technology*. (March 3). 1986.

"NASA investigating claims that Morton Thiokol demoted engineers for disclosing launch opposition." *Aviation Week and Space Technology*. (May 19). 1986.

"O-ring documentation misled managers." *Aviation Week and Space Technology*. (March 24). 1986.

"Rogers Commission report cites NASA management deficiencies." *Aviation Week and Space Technology*. (June 9 and 16). 1986.

"Shuttle cockpit 'survived the explosion.'" *New Scientist*. 110:22. 1986.

Baker, D.
"Why Challenger failed." *New Scientist*. 111(September 11):52–6. 1986.

Bell, T. E., and K. Esch.
"The fatal flaw in flight 51-L." IEEE *Spectrum*. 24(2):43. 1987.

Bower, B.
"Challenger disaster: 'Rooted in history.'" *Science News*. 129:372–73. 1986.

House Committee on Science and Technology.
"Investigation of the Challenger accident: Hearings before the committee." U.S. Congress. 99-139. U.S. Government Printing Office. Washington, D.C. 1986.

House Committee on Science and Technology.
"Investigation of the Challenger accident: Report of the Committee on Science and Technology." U.S. Congress. 99-1016. U.S. Government Printing Office. Washington, D.C. 1986.

House Committee on Science, Space and Technology.
"NASA's response to the committee's investigation of the Challenger accident." U.S. Congress. 100-7. U.S. Government Printing Office. Washington, D.C. 1987.

Jensen, C.
No Downlink: A Dramatic Narrative About the Challenger Accident and Our Time. Farrar, Straus & Giroux. New York. 1996.

Jones, P.
“Business as usual—without the business.” New Scientist. 110(May 8):54–5. 1986.

Joyce, C.
“A major malfunction.” New Scientist. 109(Feb. 6):18. 1986.

Joyce, C.
“Space shuttle: A blueprint for disaster.” New Scientist. 110(June 12):17–18. 1986.

Joyce, C., and H. Gavaghan.
“Flaw in solid fuel may have detonated the shuttle.” New Scientist. 109(Feb. 6):19–22. 1986.

Marshall, E.
“The shuttle record: Risks, achievements.” Science. 231:664–66. 1986.

National Aeronautics and Space Administration.
“Actions to implement the recommendations of the Presidential Commission on the Challenger accident.” Report to the President. U.S. Government Printing Office. Washington, D.C. 1986.

Smith, R. J.
“Commission finds flaws in NASA decision-making.” Science. 231:1237–38. 1986.

Smith, R. J.
“Experts ponder effect of pressures on shuttle blowup.” Science. 231:1495–98. 1986.

Smith, R. J.
“NASA had warning of potential shuttle accident.” Science. 231:792. 1986.

Smith, R. J.
“Shuttle inquiry focuses on weather, rubber seals, and unheeded advice.” Science. 231:909–11. 1986.

Smith, R. J.
“Thiokol had three concerns about shuttle launch.” Science. 231:1064. 1986.

Trento, J. J.
Prescription for Disaster. Crown Publishers, Inc. New York. 1987.

U.S. Senate Subcommittee on Science, Technology and Space.
“Space shuttle accident: Hearings before the subcommittee.” U.S. Congress. 99-967. U.S. Government Printing Office. Washington, D.C. 1986.

Vaughan, D.
The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA. University of Chicago Press. Chicago 1996.

Waldrop, M. M.
“The Challenger disaster: Assessing the implications.” Science. 231:661–63. 1986.

Whitehouse, D.
“A piece of Challenger.” New Scientist. 113(Jan. 29):69. 1987.

Cold Fusion

“Texas panel finds no fraud in cold fusion experiments.” New York Times. (Nov. 20):11. 1990.

Chandler, D.
“Behind the fusion confusion: A difficult test to duplicate.” Boston Globe. (May 2):A12. 1989.

Chandler, D.
"Fusion study under heavy attack: Californian cites a series of errors." *Boston Globe*. (May 2):A1, A12. 1989.
Crawford, M.
"Utah looks to Congress for cold fusion cash." *Science*. 244:522–23. 1989.
Fogle, P. W.
"Media and science: Differing perspectives." *Forum for Applied Research and Public Policy*. 7(4):98–103. 1992.
Hall, N.
"Of fusion, Nobels and nobility." *New Scientist*. (May 6):28–29. 1989.
Huizenga, J. R.
Cold Fusion: The Scientific Fiasco of the Century. University of Rochester Press. Rochester, N.Y. 1992
Lindley, D.
"Role of the press in cold fusion saga." *Forum for Applied Research and Public Policy*. 7(4):104–7. 1992.
Mallove, E. F.
Fire from Ice: Searching for the Truth Behind the Cold Fusion Furor. John Wiley & Sons, Inc. New York. 1991.
McDonald, K. A.
"U. of Utah institute, in its final report, claims 'convincing evidence' for cold fusion." *Chronicle of Higher Education*. (July 24):A8. 1991.
Saltus, R.
"Fusion study under heavy attack: MIT researchers report flawed data." *Boston Globe*. (May 2):A1, A12. 1989.
Taubes, G.
Bad Science: The Short Life and Weird Times of Cold Fusion. Random House. New York. 1993.

Gallo

Anderson, A.
"Dingell reopens Gallo-Pasteur row." *Nature*. 343(Jan. 4):3. 1990.
Anderson, A., and G. C. Anderson.
"NIH seek advice on Gallo." *Nature*. 343(Feb. 22):680. 1990.
Anderson, C.
"Hearing process proves a challenge for ORI." *Science*. 260:1714. 1993.
Anderson, C.
"ORI drops Gallo case in legal dispute." *Science*. 262:1202–3. 1993.
Anderson, C.
"Popovic is cleared on all charges: Gallo case in doubt." *Science*. 262:981–82. 1993.
Anderson, C.
"The aftermath of the Gallo case." *Science*. 263. 1993.
Anderson, C., P. Coles, and D. Concar.
"End now in sight for Gallo investigation?" *Nature*. 347(Oct. 18):603. 1990.

Anderson, C., D. Concar, and A. Anderson.
"NIH launches surprise Gallo investigation." *Nature*. 347(October 11):501. 1990.

Bor, J., and D. Birch.
"Researcher calls critics 'fanatics.'" *Baltimore Sun* (November 4):1A. 1995.

Charles, D., D. and Concar.
"America hoists the white flag in HIV war." *New Scientist*. (June 8):14. 1991.

Cohen, J.
"Stormy weather ahead for OSI's Gallo report." *Science*. 255:914–15. 1992.

Cohen, J.
"Popovic defended by technician." *Science*. 256:1623. 1992.

Cohen, J.
"U.S.-French patent dispute heads for a showdown." *Science*. 265:23–25. 1994.

Crewdson, J.
"The great AIDs quest." *Chicago Tribune*. (Nov. 19):Sect. C. 1989.

Crewdson, J.
"AIDs inquiry bypassing watchdog panel." *Chicago Tribune*. (June 17):1. 1991.

Culliton, B. J.
"Déejà vu in AIDS priority fight." *Science*. 47:1532–33. 1990.

Culliton, B. J.
"NIH goes 'extra mile' on Gallo." *Science*. 247:908. 1990.

Culliton, B. J.
"Inside the Gallo probe." *Science*. 248:1494–8. 1990.

Culliton, B. J.
"Gallo inquiry takes puzzling new turn." *Science*. 250:202–3. 1990.

Culliton, B. J.
"Which patient did Gallo's virus come from?" *Science*. 250:368. 1990.

Ezzell, C.
"AIDS co-discoverer censured for misconduct." *Science News*. 143(Jan. 9):20–1. 1993.

Gallo, R.
Virus Hunting, AIDS, Cancer, and the Human Retrovirus: A Story of Scientific Discovery. Basic Books. New York. 1991.

Gladwall, M.
"NIH memo cites possible inaccuracies in AIDS researchers' patent application." *Washington Post*. (Aug. 12): A4. 1991.

Greenberg, D.
"Advisor in the Gallo case calls for reopening probe." *Science & Government Report*. 24(9):1, 4–5. 1994.

Hamilton, D.
"What next in the Gallo case?" *Science*. 254:944–45. 1991.

Hamilton, D.
"The Richards panel tosses a curve." *Science*. 256:23. 1992.

Hilts, P. J.
"U. S. drops misconduct case against an AIDS researcher." *New York Times*. (Nov. 19):A1. 1993.

Marx, J. L.
“Strong new candidate for AIDS agent.” *Science*. 224:475–77. 1984.

Norman, C.
“AIDS virology: A battle on many fronts.” *Science*. 230:518–21. 1985.

Norman, C.
“A new twist in AIDS patent fight.” *Science*. 232:308–9. 1986.

Palca, J.
“Gallo challenged on HIV isolates.” *Science*. 251:1306. 1991.

Palca, J.
“The true source of HIV?” *Science*. 252:71. 1991.

Palca, J.
“Draft of the Gallo report sees light of day.” *Science*. 253:1347–48. 1991.

Palca, J.
“Hints emerge from the Gallo probe.” *Science*. 253:728–31. 1991.

Rubinstein, E.
“The untold story of HUT78.” *Science*. 248:1499–507. 1990.

Rubinstein, E.
“The Gallo factor: questions remain.” *Science*. 253:732. 1991.

Human Radiation Experiments

“In the name of consent: Secret radiation experiments performed on uninformed people.” *New Scientist*. 141(Feb. 19):3. 1994.

Adler, T.
“Government team tracks radiation studies.” *Science News*. 145(Jan. 15):39. 1994.

Adler, T.
“Experts debate merits of radiation studies.” *New Scientist*. 145(Feb. 5):87. 1994.

Beardsley, T.
“The Cold War’s dirty secrets.” *Scientific American*. 272(May):16. 1995.

Crigger, B.
“Daughter of the ‘National Commission.’” *Hastings Center Report*. 24(May/June):3–4. 1994.

Estling, R.
“Whatever made them do it?” *New Scientist*. 145(Jan. 21):48–9. 1995.

Faden, R.
The Human Radiation Experiments: Final Report of the Advisory Committee on Human Radiation Experiments. Oxford University Press. New York. 1996.

Macilwain, C.
“U.S. admits to use of humans in radiation experiments.” *Nature*. 367(Jan. 6):4. 1994.

Macilwain, C.
“Public protests spark ‘witch-hunt’ fears over radiation experiments.” *Nature*. 367(Jan. 27):303. 1994.

Mann, C. C.
“Radiation: Balancing the record.” *Science*. 263(Jan. 28):470–73. 1994.

Raloff, J.
“Atomic age spawned experiments on humans.” *Science News*. 146(Oct. 29):276. 1994.

Imanishi-Kari/Baltimore

Abu-hadid, M., et al.
"An open letter on OSI's methods." *Nature*. 351(June 17):693. 1991.

Anderson, C.
"NIH: Imanishi-Kari guilty." *Nature*. 350. (March 28):262–63. 1991.

Anderson, C.
"Secret Service analysis goes to pieces." *Science*. 260(June 18):1715. 1993.

Baltimore, D.
"Baltimore's travels." *Issues in Science and Technology*. 5(4):48–54. 1989.

Baltimore, D.
"Baltimore declares O'Toole mistaken." *Nature*. 351(May 30):341–43. 1991.

Baltimore, D.
"Open letter to Paul Doty." *Nature*. 353(Sept. 5):9. 1991.

Culliton, B.
"A bitter battle over error." *Science*. 240(June 24):1720–21. 1988.

Culliton, B.
"A bitter battle over error (II)." *Science*. 241(July 1):18–21. 1988.

Culliton, B.
"Dingel v. Baltimore." *Science*. 244:412–14. 1989.

Doty, P.
"Responsibility and Weaver et al." *Nature*. 352(July 18):183–84. 1991.

Edsall, J., D. S. Greenberg, and B. Healy.
"Perspectives." *Journal of NIH Research*. 3(Aug.):30–34. 1991.

Ehrenreich, B.
"Science, lies and the ultimate truth." *Time*. (May):66. 1991.

Eisen, H.
"Origins of MIT inquiry." *Nature*. 351(May 30):343–44. 1991.

Hamilton, D.
"NIH finds fraud in Cell paper." *Science*. 251(March 29):1552–54. 1991.

Hamilton, D.
"Baltimore throws in the towel." *Science*. 252(May 10):768–70. 1991.

Hamilton, D.
"Did Imanishi-Kari get a fair 'trial'?" *Science*. (June 21):1607. 1991.

Hamilton, D.
"Baltimore case—In brief." *Science*. 253(July 5):24–25. 1991.

Hamilton, D.
"OSI verdict delayed." *Science Scope*. (July 12):127. 1991.

Hamilton, D.
"Verdict in sight in the Baltimore case." *Science*. 251:1168–72. 1991

Hilts, P.
"The science mob." The New Republic. (May):24–25, 28–31. 1992

Huber, B. T., R. T. Woodland, and H. H. Wortis.
"Opinions from an inquiry panel." *Nature*. 351(June 13):514. 1991.

Imanishi-Kari, T.
"OSI's conclusions wrong." Nature. 351(May 30):344–45. 1991.

Imanishi-Kari, T.
"Imanishi-Kari's riposte." Nature. 351(June 27):691–92. 1991.

Koshland, D. E.
"The handling of leaked information." Science. 253(July 5):9. 1991.

Kuznik, F.
"Fraud busters." Washington Post Magazine. (April 14). 1991.

Loevinger, L.
"Raking over the coals." Nature. 352(July 11):120. 1991.

Maddox, J.
"Greek tragedy moves on one act." Nature. 350(March 28):269. 1991.

McDevitt, H. O., and U. Storb.
"Dissent on forensic evidence." Nature. 352(July 18):184. 1991.

Mervis, J.
"Marathon hearing gets under way." Science. 268:1561. 1995.

O'Toole, M.
"Margot O'Toole's record of events." Nature. 351(May 16):180–83. 1991.

O'Toole, M.
"O'Toole re-challenges: The Imanishi-Kari affair." Nature. 351(June 27): 692–93. 1991.

O'Toole, M.
"Imanishi-Kari (continued)." Nature. 352(Aug. 15):560. 1991.

Ptashne, M.
"More views on Imanishi-Kari." Nature. 352(July 11):101–2. 1991.

Saltus, R.
"Baltimore disputes charges he knew about forged data." Boston Globe. (May 30):342–43. 1991.

Sarasohn, J.
Science on Trial: The Whistle-blower, the Accused, and the Nobel Laureate. St. Martin's Press. New York. 1993.

Stewart, W., and N. Feder.
"Analysis of a whistle-blowing." Nature. 351(June 27):687–91. 1991.

Stone, R., and E. Marshall.
"Imanishi-Kari case: ORI finds fraud." Science. 266(Dec. 2):1468–69. 1994.

Weaver, D., M. Reis, C. Albanese, F. Constantini, D. Baltimore, and T. Imanishi-Kari.
"Altered repertoire of endogenous immunoglobulin gene expression in transgenic mice containing a rearranged Mu heavy chain gene." Cell. 45(April 25):247–59. 1986.

Weaver, D., M. Reis, D. Baltimore, and T. Imanishi-Kari.
"Altered repertoire of endogenous immunoglobulin gene expression in transgenic mice containing a rearranged Mu heavy chain gene" [a retraction]. Cell. 55(Nov. 18):541. 1988.

Milgram

Baumrind, D.
"Psychology in action: Some thoughts on the ethics of research after reading Milgram's 'Behavioral study of obedience.'" *American Psychologist.* 19:421–23. 1964.

Milgram, S.
"Problems of ethics in research." *Obedience to Authority: An Experimental View.* 193–202. Harper & Row. New York. 1975.

Milgram, S.
Obedience to Authority. Harper & Row. New York. 1983.

Miller, A. G.
The Obedience Experiments. Praeger. New York. 1986.

Patten, S. C.
"The case that Milgram makes." *Philosophical Review.* 86(3):350–64. 1977.

Other

Amato, I.
"Rustum Roy: PR is a better system than peer review." *Science.* 258:736. 1992.

Anderson, A.
"Controversial NIH genome researcher leaves for new $70 million institute." *Nature.* 358. 1992.

Anderson, C.
"NIH laboratory admits to fabricated embryo research, retracts paper." *Nature.* 357:427. 1992.

Anderson, C.
"Pasteur notebooks reveal deception." *Science.* 259(Feb. 19):1117. 1993.

Anderson, C.
"A speeding ticket for NIH's controversial cancer star." *Science.* 259:1391–92. 1993.

Anderson, C.
"Hughes' tough stand on industry ties." *Science.* 260. 1993.

Anderson, C.
"Scripps-Sandoz deal comes under fire." *Science.* 260:1872–73. 1993.

Anderson, C.
"Michigan gets an expensive lesson." *Science.* 262(Oct. 1):23. 1993.

Angler, N.
Natural Obsessions: The Search for the Oncogene. Houghton Mifflin. Boston. 1988.

Associated Press.
"Researcher indicted on charges of falsifying data for grant." *New York Times.* (April 16):6. 1988.

Blumenstyk, G.
"Business and philanthropy notes: Dartmouth finds no basis for charges of scientific misconduct." *Chronicle of Higher Education.* (Feb. 17):A29. 1993.

Brand, D.
"It was too good to be true." *Time.* (June 1):59. 1987.

Cohen, J.
"Army investigates researcher's report of clinical trial data." *Science.* 258:883–84. 1992.

Cohen, J.
"Army clears Redfield—but fails to resolve controversy." *Science*. 261(Aug. 13):824–25. 1993.

Cohen, J.
"Peer review triumphs over lobbying." *Science*. 263(Jan. 28):463. 1994.

DeGeorge, R. T.
"Ethical responsibility of engineers in large corporations: The Pinto case." *Business and Professional Ethics Journal*. 1(Fall):1–14. 1981.

Fernie, J. D.
"The Neptune affair." *American Scientist*. 83(March/April):116–19. 1995.

Fielder, J. H., and D. Birsch.
The DC-10 Case: A Study in Applied Ethics, Technology, and Society. State University of New York Press. Albany, N.Y. 1992.

Friedly, J.
"After 9 years, a tangled case lurches toward a close." *Science*. 272:947–48. 1996.

Gibbons, A.
"Scripps signs a deal with Sandoz." *Science*. 258:1570. 1993.

Greenberg, D.
"Researcher sounds fraud alarm—and loses NIMH Grant." *Science and Government Report*. 17:1–3. 1987.

Holden, C.
"NIMH finds a case of serious misconduct." *Science*. 235:1566–67. 1987.

Holden, C.
"Breuning's accuser has grant deferred." *Science*. 236:144. 1987.

Holden, C.
"Briefings." *Science*. 248:883–86. 1991.

Jones, J.
Bad Blood: The Tuskeegee Syphilis Experiment. Free Press. New York. 1993.

Kohn, P. M., and R. V. Hughson
"Perplexing problems in engineering ethics." *Chemical Engineering*. 85(May 5):96–107. 1980.

Marshall, E.
"Fight over data disrupts Michigan State project." Science. 251:23–24. 1991.

Marshall, E.
"When does intellectual passion become conflict of interest?" *Science*. 257:620–23. 1992.

Medvedev, G.
The Truth About Chernobyl. Basic Books. New York. 1990.

Mele, C.
"Scientist says cell-center chief ruining his career." *Press-Republican*. (Oct. 30):15. 1990.

Mervis, J.
"Bitter suit over research work asks 'who deserves the credit?'" *The Scientist*. 3(8):1, 4–5. 1989.

Pool, R.
"More squabbling over unbelievable result." *Science*. 241:658. 1988.

Roberts, L.
"Misconduct: Caltech's trial by fire." *Science*. 253:1344–47. 1991.

Roberts, L.
"NIH gene patents, round two." *Science*. 255:912–13. 1992.

Roberts, L.
"Gene patents: Rumors fly over rejection of NIH claim." *Science*. 257:1855. 1992.

Rossiter, E. J. R.
"Reflections of a whistle-blower." *Nature*. 357(June 11):434–36. 1992.

Sawyer, K.
"Amid scandal, NASA studies 'integrity' of degrees awarded to its employees." *Washington Post*. (July 22):A9. 1991

Soyfer, V. N.
"New light on the Lysenko era." *Nature*. 39(June 8):415–20. 1989.

Stone, R.
"Science scope: mix-up closes misconduct hearings." *Science*. 260(May 14):883. 1993.

Talent, J. A.
"The case of the peripatetic fossils." *Nature*. 338(April 20):613–15. 1989.

Taubes, G.
"The disputed birth of buckyballs." *Science*. 253:1476–79. 1991.

Taubes, G.
"Costly settlement ends whistle-blower suit." *Science*. 263:605. 1994.

Zurer, P. S.
"Contract labs charged with fraud in analyses of superfund samples." *Chemistry & Engineering News*. (Feb. 15):14–16. 1991.

Topic Bibliography

General

Office of Research Integrity Newsletter. U.S. Public Health Service. 1993.

"Special news report: Conduct in science." *Science*. 268:1705–18. 1995.

Babbage, C.
Reflections on the Decline of Science in England and Some of Its Causes. B. Fellowes. London. 1830.

Baenen, L.
"Medical school's woes raise questions about research ethics." *Valley News* (Lebanon, N.H.). (April 19):15, 19. 1993.

Barber, A.
"Academic research environment." *Partial testimony to H.R. Committee on Space, Science and Technology*. 1990.

Barbour, I.
Technology, Environment, and Human Values. Praeger. New York, NY. 1980.

Barinaga, M.
"Labstyles of the famous and well funded." *Science*. 252(June 28):1776–78. 1991.

Bebeau, M., K. Pimple, K. Muskavitch, D. Smith, and S. Borden.
Moral Reasoning in Scientific Research: Cases for Teaching and Assessment. The Poynter Center for the Study of Ethics. Bloomington, Ind. 1995.

Benditt, J., J. Cohen, E. Marshall, and G. Taubes.
"Special news report: Conduct in science." *Science*. 268:1705–18. 1995.

Bland, C. J., and C. C. Schmitz.
"Characteristics of the successful researcher and implications for faculty development." *Journal of Medical Education*. 61:22–31. 1986.

Bok, S.
Secrets: On the Ethics of Concealment and Revelation. Pantheon. New York. 1982.

Bulger, R. E., E. Heitman, and S. J. Reiser.
The Ethical Dimensions of the Biological Sciences. Cambridge University Press. Cambridge. 1993.

Bush, V.
Science, the Endless Frontier: A Report to the President on a Program for Postwar Scientific Research. National Science Foundation. Washington, D.C. 1980.

Chalk, R.
Science Technology and Society: Emerging Relationships. American Association for the Advancement of Science. Washington, D.C. 1988.

Chalk, R., and P. Woolf.
"Regulating a 'knowledge business.'" *Issues in Science and Technology*. 5:33–35. 1989.

Chalmers, A. F.
What Is this Thing Called Science? University of Queensland Press. Queensland. 1982.

Cheyney, D.
Ethical Issues in Research. University Publishing Group. Frederick, Md. 1993.

Committee on Academic Responsibility.
Fostering Academic Integrity: Report of the Committee on Academic Responsibility. Massachusetts Institute of Technology. Cambridge, Mass. 1992.

Committee on Science, Engineering, and Public Policy.
On Being a Scientist: Responsible Conduct in Research. Second edition. National Academy Press. Washington, D.C. 1995.

Connolly, T.
Scientists, Engineers, and Organizations. Brooks/Cole Engineering Division. Monterey, Calif. 1983.

Cooke, R.
Experts in Uncertainty. Oxford University Press. New York. 1991.

Curd, M., and L. May.
Professional Responsibility for Harmful Actions. Kendall/Hunt Publishing Co. Dubuque, Ia. 1984

Cutcliffe, S. H., J. A. Mistichelli, and C. M. Roysdon.
Technology and Values in American Civilization: A Guide to Information Sources. Gale Research Co. Detroit, Mich. 1980.

De Deyn, P.
The Ethics of Animal and Human Experimentation. John Libbey. London, England. 1994.

DeForest, P., M. Frankel, J. Poindexter, and V. Weil.
Biotechnology: Professional Issues and Social Concerns. American Association for the Advancement of Science. Washington, D.C. 1988.

Diener, E., and R. Crandall.
Ethics in Social and Behavioral Research. University of Chicago Press. Chicago, Ill. 1979.

Djerassi, C.
Cantor's Dilemma. Doubleday. New York. 1989.

Downie, R. S.
Roles and Values. Methuen & Co. London. 1971.

Draper, E.
Risky Business: Genetic Testing and Exclusionary Practices in the Hazardous Workplace. Cambridge University Press. Cambridge. 1991.

Durbin, P.
Social Responsibility in Science, Technology, and Medicine. Lehigh. Bethlehem, Pa. 1992.

Elliott, D., and J. E. Stern.
Research Ethics: A Reader. University Press of New England. Hanover, N.H. 1997.

Engelhardt, H. T., and D. Callahan.
Morals, Science and Sociality. Hastings Center. Hastings-on-Hudson, N.Y. 1978.

Engler R. L., J. W. Covell, P. J. Friedman, P. S. Kitcher, and R. M. Peters.
"Misrepresentation and responsibility in medical research." *New England Journal of Medicine*. 317(22):1383–89. 1983.

Erwin, E., S. Gendin, and L. Kleiman.
Ethical Issues in Scientific Research. Garland. New York. 1994.

Franklin, A.
The Neglect of Experiment. Cambridge University Press. Cambridge. 1986.

Gert, B.
Morality. Oxford University Press. New York. 1988.

Gert, B.
"Morality versus slogans." *Papers Presented to the Center for the Study of Ethics in Society*. 3(2). Western Michigan University. Kalamazoo, Mich. 1989.

Gould, S. J.
The Mismeasure of Man. Norton. New York. 1981.

Grinnell, F.
The Scientific Attitude. Westview Press. Boulder, Colo. 1987.

Guinan, M. E.
"Scientific standards and studies of women: Lack of adherence to established principles by scientists, scientific journals, and science writers." *Journal of Women's Health*. 1(2):93–94. 1992.

Hull, D. L.
Science as Process: An Evolutionary Account of the Social and Conceptual Development of Science. University of Chicago Press. Chicago. 1988

Jackson, I.
Honor in Science. Sigma Xi. New Haven, Conn. 1986.

Jasanoff, S.
"Innovation and integrity in biomedical research." *Academy of Medicine*. 68(9):S91–95. 1993.

Kimmel, A. J.
Ethics and Values in Applied Social Research. Sage. Newbury Park, Calif. 1988.

Kitcher, P.
The Advancement of Science: Science Without Legend, Objectivity Without Illusions. Oxford University Press. New York. 1993.

Korenman, S., and A. Schipp.
Teaching the Responsible Conduct of Research through a Case Study Approach. American Association of Medical Colleges. Washington, D.C. 1994.

Kuhn, T.
The Structure of Scientific Revolutions. University of Chicago Press. Chicago. 1970.

Lal, G. B.
"Popularization of science through news." *Philosophy of Science*. 12(2):41–44. 1945.

Laudan, L.
Science and Relativism: Some Key Controversies in the Philosophy of Science. University of Chicago Press. Chicago, Ill. 1990.

Longino, H.
Science as Social Knowledge: Values and Objectivity in Scientific Inquiry. Princeton University Press. Princeton, N.J. 1990.

Macrina, F. L.
Scientific Integrity: An Introductory Text with Cases. ASM Press. Herndon, Va. 1995.

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

Medawar, P.
The Limits of Science. Oxford University Press. New York. 1984.

Miller, D. J., and M. Hersen.
Research Fraud in the Behavioral and Biomedical Sciences. John Wiley & Sons. New York. 1992.

National Academy of Science.
Responsible Science: Executive Summary. National Academy Press. Washington, D.C. 1992.

Nelkin, D.
Science as Intellectual Property. Macmillan. New York. 1984.

Olson, S.
Shaping the Future. Georgetown University Press. Washington, D.C. 1989.

Parker, D. B.
Ethical Conflicts in Computer Science and Technology. International. Menlo Park, Calif. 1978.

Penslar, R. L.
Research Ethics: Cases and Materials. Indiana University Press. Indianapolis. 1995.

Perry, T.
"Five ethical dilemmas." IEEE *Spectrum*. 18:53–60. 1981.

Petersdorf, R. G.
"The pathogenesis of fraud in medical science." *Annals of Internal Medicine*. 104:252–54. 1986.

Quinn, D.
Ishmael. Bantam Books. New York. 1992.

Schwartz, C.
"Information for students: Military aspects of careers in science series." Social Responsibility. 2(5):1–17. 1989.

Segerstedt, T.
Ethics for Science Policy. Pergamon. Elmsford, N.Y. 1979.

Shrader-Frechette, K.
Ethics of Scientific Research. Rowman & Littlefield. Lanham, Md. 1994.

Sieber, J. E.
Planning Ethically Responsible Research. Sage. Newbury Park, Calif. 1992.

Sigma Xi.
"Ethics, values, and the promise of science." *Sigma Xi Forum Proceedings*. February 25–26. Sigma Xi. Research Triangle Park, N.C. 1993.

Smith, A.
Lectures on Jurisprudence. R. L. Meek, D. D. Raphael, and P. G. Stein, eds. Oxford University Press. New York. 1978.

Stanley, B., J. E. Sieber, and G. G. Melton.
"Empirical studies of ethical issues in research: A research agenda." American Psychologist. 42:735–41. 1987.

Whitbeck, C.
"Trustworthy research". *Science and Engineering Ethics*. 1(4). 1995.

Teaching and Learning

Baird, L.
"The melancholy of anatomy: Personal and professional development of graduate/professional school students." In *Higher Education: Handbook of Theory and Research*. Vol. VI. 361–92. J. C. Smart, ed. Agathon. New York. 1990.

Bebeau, M.
"Can Ethics Be Taught? A Look at the Evidence." *Journal of the American College of Dentists*. 58(1):10–15. 1991.

Bok, D.
Beyond the Ivory Tower, Social Responsibilities of the Modern University. Harvard University Press. Cambridge, Mass. 1982.

Callahan, D., and S. Bok.
Ethics Teaching in Higher Education. Plenum. New York. 1980.

Darling, L.
"What to do about toxic mentors." *Nurse Educator*. 11(2):29–30. 1986.

Davis, M.
"Who can teach workplace ethics?" *Teaching Philosophy*. 13:21–38. 1990.

Gosling, D., and B. Musschenga.
Science Education and Ethical Values. Georgetown University Press. Washington, D.C. 1985.

Hacket, E. J.
"Science as a vocation in the 1990's: The changing organizational culture of academic science." *Journal of Higher Education*. 61(3):241–79. 1990.

Hastings Center.
The Teaching of Ethics in Higher Education. Hastings Center. Hastings-on-Hudson, N.Y. 1980.

Kurfiss, J.
"Intellectual, psychological, and moral development in college: Four major theories." *Manual for Project Que*. Council for Independent Colleges. Washington, D.C. 1983.

Macrina, F., and C. Munro.
"Graduate teaching in principles of scientific integrity." *Academic Medicine*. 68:879–84. 1993.

Merriam, S., T. Thomas, and C. Zeph.
"Mentoring in higher education: What we know now." *Review of Higher Education*. 11(2):199–210. 1987.

Piper, T., M. Gentile, and S. Parks.
Can Ethics Be Taught? Harvard University Press. Boston. 1993.

Reiser, S., and E. Heitman.
"Creating a course on ethics in the biological sciences." *Academic Medicine*. 68(12):876–79. 1993.

Rest, J. R.
Development in Judging Moral Issues. University of Minnesota. Minneapolis. 1979.

Rest, J. R.
"Moral development in young adults." In *Adult Cognitive Development: Methods and Models*. 92–111. R. Mines and K. Kitchener, eds. Praeger. New York. 1986.

Rest, J. R.
"Can ethics be taught in professional schools? The psychological research." *Easier Said Than Done*. (Winter):22–26. 1988.

Rubenstein, A.
"IOM recommends standard, curriculum, and oversight to improve research conduct." *Tough Questions*. (Summer):1, 15. 1989.

Sachs, G., and M. Siegler.
"Teaching scientific integrity and the responsible conduct of research." *Academic Medicine*. 68(12):871–75. 1993.

Shapiro, B.
Hints for Case Teaching. Harvard Business School. Boston. 1984.

Swazey, J., M. Anderson, and K. Louis.
"Ethical problems in academic research." *American Scientist*. 81:542–53. 1993.

Swazey, J., K. Louis, and M. Anderson.
"University policies and ethical issues in research and graduate education: Highlights of the CGS deans' survey." *CGS Communicator*. 23(3): 1–3, 7–8. 1989.

Trow, M.
"Higher education and moral development." *AAUP Bulletin*. 61(4):20–27. 1976.

Velasquez, M.
Business Ethics: Concepts and Cases. Third edition. Prentice Hall. Englewood Cliffs, N.J. 1992.

Methodology

"Opinion poll: Fraud in the lab needs policing, say researchers." *R&D Magazine*. (Oct.). 1990.

"Science & society: NAS sizes up scientific misconduct." *Science News*. 141(May 2):303. 1992.

Anderson, C.
"Data ownership. But what is the problem?" *Nature*. 345:8. 1990.

Anderson, C.
"Survey tracks misconduct, to an extent." *Science*. 262(Nov. 19):1203–4. 1993.

Anderson, C.
"Misconduct panel sets ambitious agenda." *Science*. 264:1841. 1994.

Bailar, J.
"Science, statistics and deception." *Annals of Internal Medicine*. 104(2):259–60. 1986.

Bailar, J., and F. Mosteller.
Medical Uses of Statistics. Second edition. New England Journal of Medicine Books. Boston, Mass. 1992.

Bechtel, H. K., and W. Pearson.
"Deviant scientists and scientific deviance." *Southern Sociological Society*. 1984.

Bird, S. J., and D. E. Housman.
"Trust and the collection, selection, analysis and interpretation of data: A scientist's view." *Science and Engineering Ethics*. 1:371–82. 1995.

Broad, W. J.
"Fraud and the structure of science." *Science*. 212(April 10):137–41. 1981.

Chubin, D. E.
"Misconduct in research: An issue of science policy and practice." *Minerva*. 23(2):175–202. 1985.

Council on Ethical and Judicial Affairs/Council on Scientific Affairs.
"Scientific fraud and misrepresentation." *Joint Report to the AMA*. American Medical Association. Chicago, Ill. (Dec.). 1989.

Crossen, C.
"Margin of error, studies galore support products and positions, but are they reliable?" *Wall Street Journal*. (Nov. 14):1. 1991.

Diamond, G. A.
"Bird brains: The evolution of scientific misconduct." *American Journal of Cardiology*. 66(Aug. 1):372–74. 1990.

Dingell, J.
"Shattuck lecture—misconduct in medical research." *New England Journal of Medicine*. 328(22):1610. 1992.

Fienberg, S.
"Damn lies and statistics: Misrepresentations of honest data." *Ethics and Policy in Scientific Publication*. 202–18. Council of Biology Editors. Bethesda, Md. 1990.

Friedman, P. J.
"Mistakes and fraud in medical research." *Law, Medicine and Health Care*. 20(Spring/Summer):17–25. 1992.

Goodstein, D.
"Scientific fraud." *American Scholar*. 60(4):505–15. 1991.

Kassirer, J.
"The frustrations of scientific misconduct." *New England Journal of Medicine*. 328(22):1634. 1993.

Latour, B., and S. Woolgar.
Laboratory Life: The Social Construction of Scientific Facts. Second edition. Princeton University Press. Princeton, N.J. 1986.

Lock, S., and F. Wells.
Fraud and Misconduct in Medical Research. BMJ. London. 1993.

MacIntosh, N. J.
Cyril Burt: Fraud or Framed? Oxford University Press. New York. 1995.

National Institutes of Health.
"Final findings of scientific misconduct." NIH *Guide*. 22(23). 1993.

Racker, E.
"A view of misconduct in science." *Nature*. 339:91–93. 1989.

Rayl, A. J. S.
"Misconduct cases stress importance of good notekeeping." *The Scientist*. (Nov. 11):18–20. 1991.

Rhoades, L. J.
Data Management in Biomedical Research. Report of a workshop. (April). 1990.

Rostand, J.
Error and Deception in Science. Hutchinson. London. 1960.

Russell, L.
Educated Guesses. University of California. Berkeley. 1994.

Schmaus, W.
"Fraud and the norms of science." *Science, Technology, & Human Values*. 8(4):12–22. 1983.

Segerstrale, U.
"The murky borderland between scientific intuition and fraud." *International Journal of Applied Philosophy*. 5(1)11–18. 1990.

Stipp, D.
"Test-tube fraud: Competition in science seems to be spawning cases of bad research." Wall Street Journal. 206(9):1, 15. 1985.

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

Weiss, P.
"Conduct unbecoming?" *New York Times Magazine*. (Oct. 29):40–41, 68, 71, 95. 1989.

Woolf, P. K.
"Deception in scientific research." *Jurimetrics Journal*. 29(1):67–95. 1988.

Zuckerman, H.
"Deviant behavior and social control in science." In *Deviance and Social Change*. 87–138. E. Sagaran, ed. Sage. Beverly Hills, Calif. 1977.

Reporting

Ethics and Policy in Scientific Publication. Council of Biology Editors. Bethesda, Md. 1990.

"Plagiarism." *Perspectives on the Professions*. 13(1):1–8. Center for the Study of Ethics in the Professions. Chicago. 1993.

Style Manual for Science. Council of Biology Editors. Bethesda, Md. 1990.

American Chemical Society.
"Ethical guidelines to publication of chemical research." *Accounts of Chemical Research*. 27:6, 179–81. 1994.

Bailar, J. C., et al.
"Editorial Policy Committee, Council of Biology Editors Report." *Ethics and Policy in Scientific Publication*. 6–11, 26–31. Council of Biology Editors. Bethesda, Md. 1990.

Broad, W. J.
"The publishing game: Getting more for less." *Science*. 211:1137–39. 1981.

Burnham, J.
How Superstition Won and Lost Science. Rutgers University Press. New Brunswick, N.J. 1987.

Cohn, V.
News and Numbers: A Guide to Reporting Statistical Claims and Controversies in Health Fields. Iowa State University Press. Ames. 1989.

Council of Biological Education Style Manual Committee.
"Ethical conduct in authorship and publication." CBE *Style Manual*. Fifth edition. 1–6. 1983.

Cranberg, L.
"The plague of plagiarism persists in modern science." *The Scientist*. (Feb. 3). 1992.

Croll, R.
"The noncontributing author: An issue of credit and responsibility." Perspectives in Biology and Medicine. 27(3):401–7. 1984.

Day, R. A.
How to Write and Publish a Scientific Paper. Fourth edition. Oryx Press. Phoenix, Ariz.. 1994.

Endocrine Society Publications Committee.
"Ethical guidelines for publications of research." *Endocrinology*. 132(1):1–2. 1993.

Halperin, E. C., J. Scott, and S. L. George.
"Multiple authorship in two English-language journals in radiation oncology." Academic Medicine. 67(12):850–6. 1992.

Hanson, S. M. H.
"Collaborative research and authorship credit: Beginning guidelines." *Nursing Research*. 37(1):49–51. 1988.

Hodge, S., and D. Greenberg.
"Publication credit." *Science*. 213. 1981.

Huth, E. J.
"Irresponsible authorship and wasteful publication." *Annals of Internal Medicine*. 104(2):258. 1986.

International Committee of Medical Journal Editors.
"Guidelines on authorship." *British Medical Journal*. 291:722. 1985.

International Committee of Medical Journal Editors.
"Statements from the International Committee of Medical Journal Editors." *Journal of the American Medical Association*. 265(20):2697–98. 1991.

Kohn, A., and M. Bazilai.
"Uptake and incorporation of 14 authors in a preliminary communication." *Biochemistry in Israel*. (July):272–73. 1991.

Koshland, D. E.
"The handling of leaked information." *Science*. 253(July 5):9. 1991.

LaFollette, M.
Stealing into Print: Fraud, Plagiarism, and Misconduct in Scientific Publishing. University of California. Berkeley. 1992.

Lanken, P. N., M. L. Osborne and P. B. Terry.
"Should our journals publish research sponsored by the tobacco industry?" *American Journal of Respiratory Cell and Molecular Biology*. 12(2):121–22. 1995.

Lanken, P. N., M. L. Osborne, and P. B. Terry.
"Introduction: The ethics of publishing research sponsored by the tobacco industry in ATS/ALA journals." *American Journal of Respiratory and Critical Care Medicine*. 51(2):269–70. 1995.

Merton, R. K.
"The Matthew effect in science: The reward and communication systems of science are considered." *Science*. 159:56–63. 1968.

Nelkin, D.
Selling Science: How the Press Covers Science and Technology. W. H. Freeman. New York. 1987.

Relman, A. S.
"Publishing biomedical research: Roles and responsibilities." *Hastings Center Report*. (May/June):23–27. 1990.

Szklo, M.
"Issues in publication and interpretation of research findings." *Journal of Clinical Epidemiology*. 44(Suppl. I):109S–113S. 1991.

Taubes, G.
"Plagiarism suit wins; experts hope it won't set a trend." *Science*. 26:1125. 1995.

Funding and Peer Review

"How Many Shades of Grey?" University of Illinois Board of Trustees. Champaign-Urbana. 1992.

Bailar, J. C., and K. Patterson.
"Journal peer review: The need for a research agenda." *New England Journal of Medicine*. 312(10):654–57. 1985.

Bishop, J. M., M. Kirschner, and H. Varmus.
"Science and the new administration." *Science*. 259(Jan. 22):444–45. 1993.

Carrow, R. P.
"Judicial review of peer review." *Journal of NIH Research*. 1(Nov./ Dec.):117–18. 1989.

Chubin, D. E., and E. J. Hacket.
Peerless Science. State University of New York Press. Albany. 1990.

Kistiakowsky, V.
"Military funding of university research." *Annals of the American Academy of Political and Social Science: Universities and the Military*. 502:141–54. 1989.

Marshall, E.
"Researchers sue to get reviewer names." *Science*. 263:747. 1994.

Marshall, E.
"Peer review reforms get good review." *Science*. 265:467. 1994.

Matthysse, S.
"The influence of funding agencies on the course of science." Paper given at the Social Issues Roundtable of the Annual Meeting of the Society for Neuroscience. Anaheim, Calif. (Nov.) 1984.

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

Taubes, G.
"Peer review goes under the microscope." *Science*. 262(Oct. 1):25–26. 1993.

Institutional Responsibility

"Even misconduct trials should be fair." *Nature*. 50(March 28):259–60. 1991.

"IOM report of a study on the responsible conduct of research in the health sciences." *Clinical Research*. 37(2):179–91. 1989.

"Misconduct in science and engineering; final rule." *Federal Register*. 56(93):22286–90. 1991.

"Opportunity for a hearing on Office of Research Integrity scientific misconduct findings." *Federal Register*. 57(216):53125–26. 1992.

"ORI releases names of researchers involved in confirmed cases of scientific misconduct." *Washington Fax*. (June 22). 1993.

"Policies and procedures for dealing with possible scientific misconduct in extramural research; Notice." *Federal Register*. 56(114):27384–94. 1991.

"Responsibilities of awardee and applicant institutions for dealing with and reporting possible misconduct in science." *Federal Register*. 54(151):32446–51. 1989.

AAMC (Association of American Medical Colleges).
Beyond the "Framework": Institutional Considerations in Managing Allegations of Misconduct. Association of American Medical Colleges. Washington, D.C. 1992.

AAMC Ad Hoc Committee.
The Maintenance of High Ethical Standards in the Conduct of Research.
Association of American Medical Colleges. Washington, D.C. 1982.

American Institute of Chemists.
The Chemist's Creed. American Institute of Chemists. 1965.

Anderson, C.
"Science scope: Another blow for ORI." *Science*. 262:643. 1993.

Anderson, C.
"Breast cancer: How not to publicize a misconduct finding." *Science*. 263:1679. 1994.

Anderson, M., K. Louis, and J. Earle.
"Disciplinary and departmental effects on observations of faculty and graduate student misconduct." *Chronicle of Higher Education*. 65(3). 1994.

Baum, R. J.
"The limits of professional responsibility." *Engineering Professionalism and Ethics*. 287–94. John Wiley & Sons. New York. 1983.

Buzzelli, D. E.
"The measurement of misconduct." *Knowledge*. 14(Dec.):205–11. 1992

Buzzelli, D. E.
"NSF's approach to misconduct in science." *Accountability in Research*. 3:215–221. 1993.

Buzzelli, D. E.
"The definition of misconduct in science: A view from NSF." *Science*. 259:584–85, 647–48. 1993.

Buzzelli, D. E.
"NSF definitions of misconduct in science." *Centennial Review*. 38(2): 273–96. 1994.

Charrow, R. P.
"The False Claims Act can trap researchers." *Journal of NIH Research*. 4:55–58. 1992.

Charrow, R. P.
"Bench notes judgments: A primer on research ethics: Learning to cope with federal regulation of research." *Journal of NIH Research*. 5:76–78. 1993.

Chubin, D. E., and M. C. LaFollette.
"Science community needs its conduct rules to be explicit." *The Scientist*. (Feb. 5):17, 19. 1990.

Commission on Research Integrity.
"Integrity and misconduct in research." Report to the Secretary of Health and Human Services. Washington, D.C. 1995.

Council of Graduate Schools.
"Research Student and Supervisor." Council of Graduate Schools. Washington, D.C. 1990.

Culliton, B.
"NIH need clear definition of fraud." *Nature*. 352(Aug. 15):563. 1991.

Culliton, B.
"Misconduct definitions still prove elusive." Nature. 369:513. 1994.

Department of Health and Human Services.
"ALERT system for institutions, organizations and individuals for possible misconduct in science." (October 15):draft. Washington, D.C. 1985.

Eisner, R.
"Institutions hustle to meet NIH ethics training mandate." *The Scientist*. (Oct. 28):1, 8, 10, 25. 1991.

Friedman, P. J.
"Research ethics, due process, and common sense." *Journal of the American Medical Association*. 260(13):1937–38. 1988.

Fry, S. T.
"Ethical issues in research: Scientific misconduct and fraud." *Nursing Outlook*. (Nov./Dec.). 1990.

Greenberg, D.
"Issue of scientific fraud not easily faced." *Chicago Tribune*. (Aug. 16):13. 1989.

Gunsalus, C. K.
"On scientific misconduct in university research." *Knowledge: Creation, Diffusion, Utilization*. 14(2):162–67. 1992.

Gunsalus, C. K.
"Institutional structure to ensure research integrity." *Academic Medicine*. 68(9 Suppl.):S33–38. 1993.

Herman, K. G., P. L. Sunshine, M. K. Fisher, J. J. Zwolenik, and C. Herz.
"Investigating misconduct in science: The National Science Foundation Model." *Journal of Higher Education*. 65(3):384–400. 1994.

Hilts, P.
"Two universities pay U.S. $1.6 million in research fraud case." *New York Times*. (July 23):9. 1994.

Institute of Medicine Committee on the Responsible Conduct of Research.
The Responsible Conduct of Research in the Health Sciences. National Academy. Washington, D.C. 1989.

Johnson, D.
"Science-policy Focus: 'Can scientific misconduct be stopped without new legislation?'" *Council of Scientific Society Presidents News*. (Nov.). 1990.

Kaiser, J.
"Commission proposes new definition of misconduct." *Science*. 269:1811. 1995.

Kaiser, J.
"Panel urges new approach to inquiries." *Science*. 270:1431. 1995.

Littlejohn, M. T., and C. M. Matthews.
"Scientific misconduct in academia: Efforts to address the issue." CRS *Report for Congress*. Congressional Research Service. Washington, D.C. (June 30). 1989.

Marshall, E.
"MSU officials criticized for mishandling data dispute." *Science*. 259:592–94. 1993.

Massachusetts Institute of Technology.
"Fostering academic integrity." *Report of the Committee on Academic Responsibility*. Massachusetts Institute of Technology. Cambridge. 1992.

Mazur, A.
"The experience of universities in handling allegations of fraud or misconduct in research." *Project on Scientific Fraud and Misconduct*. 67–94. AAAS. Washington, D.C. 1989.

Mishkin, B.
"The investigation of scientific misconduct: Some observations and suggestions." *New Biologist*. 3(9)821–33. 1991.

Mishkin, B.
"Ethics, law and public policy." *Professional Ethics Report*. V(1):5–6. 1992.

National Institutes of Mental Health.
Guidelines for the Conduct of Research at the National Institutes of Health. National Institutes of Health. Bethesda, Md. (March 21). 1990.

Office of Inspector General.
Semiannual Report to the Congress. 9/1/92–3/31/93. (8). National Science Foundation. Washington, D.C. 1993.

Panel on Scientific Responsibility and the Conduct of Research.
Responsible Science: Ensuring the Integrity of the Research Process. Volumes I and II. National Academy Press. Washington, D.C. 1993.

Schachman, H. K.
"What is misconduct in science?" *Science*. 261:148–49, 183. 1993.

Stone, R.
"ORI, FASEB feud over new rules." *Science*. 266:19. 1994.

Teich, A. H., and M. S. Randall.
Responsible Scientists: Meeting the Challenge of Fraud and Misconduct in Science. AAAS. Washington D.C. 1992.

U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations.
Fraud in NIH Grant Programs. 100th Cong., 2nd Sess., April 2. No. 100-189. U.S. Government Printing Office. Washington, D.C. 1989.

U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations.
Scientific Fraud. 101st Cong., 1st Sess., May 4, 9. No. 101-64. U.S. Government Printing Office. Washington, D.C. 1989.

U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations.
Scientific Fraud, Part 2. 101st Cong., 1st Sess., April 30 and May 14. U.S. Government Printing Office. Washington, D.C. 1990.

U.S. Congress, House of Representatives, Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight.
Maintaining the Integrity of Scientific Research. 101st Cong., 1st Sess., June 28. No. 73. U.S. Government Printing Office. Washington, D.C. 1990.

U.S. Congress, Office of Technology Assessment.
Biomedical Ethics in U.S. Public Policy: Background Paper. U.S. Government Printing Office. Washington, D.C. 1993.

U.S. Department of Health and Human Services.
"Office of Research Integrity: An Introduction." Public Health Service. Rockville, Md. 1993.

U.S. Department of Health & Human Services.
Office of Research Integrity Biennial Report 1991–1992. Public Health Service. Rockville, Md. (Sept.). 1993.

U.S. Department of Health & Human Services.
Office of Research Integrity Annual Report 1994. Public Health Service. Rockville, Md. (April). 1995.

University of Illinois.
Policy and Procedures on Academic Integrity in Research and Publication. University of Illinois. Champaign-Urbana. (Sept. 17). 1991.

Wheeler, D.
"New body proposed to help universities on fraud issues." *Chronicle of Higher Education*. (April 29):A11. 1992.

Widnall, S.
"AAAS presidential lecture: Voices from the pipeline." *Science*. 241:1740–45. 1988.

Zwolenik, J. J.
"New definitions of misconduct: Priorities for the 1990s." *Knowledge*. 14(Dec.):168–173. 1992.

Whistleblowing

Boone, C. K.
"When scientists go public with their doubts." *Hastings Center Report*. (Dec.):12–17. 1982.

Devine, T. M., and D. G. Aplin.
"Whistleblower protection—The gap between the law and reality." *Howard Law Journal*. 31(2):223–39. 1988.

Glazer, M. P., and P. M. Glazer.
The Whistleblowers: Exposing Corruption in Government and Industry. Basic Books. New York. 1989.

Government Accountability Project.
"Courage without martyrdom: A survival guide for whistleblowers." Project on Government Procurement. Washington, D.C. 1989.

Poon, P.
"Legal protections for the scientific misconduct whistleblower." *Journal of Law, Medicine and Ethics*. 23:88–95. 1995.

Subcommittee on the Civil Services.
"Whistleblower protection: Determining whether reprisal occurred remains difficult." (Oct. 27). U.S. General Accounting Office. Washington, D.C. 1992.

Swazey, J. P., and S. R. Scher.
"Whistleblowing in biomedical research: Policies and procedures for responding to reports of misconduct." *Study of Ethical Problems in Medicine, Biomedical and Behavioral Research*. U.S. Government Printing Office. Washington, D.C. 1981.

U.S. Committee on Science, Space, and Technology.
"Discussion draft of a bill in the House of Representatives to promote the integrity of scientific research." U.S. House of Representatives. (July 19). 1990.

Weil, V.
Beyond Whistleblowing: Defining Engineers' Responsibilities. Center for the Study of Ethics in the Professions. IIT. Chicago. 1983.

Conflict of Interest

"Conflicts of interest: Panel discusses options for management." *Professional Ethics Report*. 6(2):1, 8. 1993.

AAMC (Association of American Medical Colleges) Ad Hoc Committee on Misconduct.
"Guidelines for dealing with faculty conflicts of commitment and conflicts of interest in research." Association of American Medical Colleges. Washington, D.C. 1990.

AAMC Ad Hoc Committee on Misconduct.
"Guidelines for dealing with faculty conflicts of commitment and conflicts of interests in research." Association of American Medical Colleges. Washington, D.C. 1993.

Anderson, C.
"Genome project goes commercial." *Science*. 259(Jan. 15):300–2. 1993.

Anderson, C.
"White House seeks uniform policy." *Science*. 261(Sept. 17):1516. 1993.

Association of American Universities.
"Framework document on managing financial conflicts of interest." Washington, D.C. 1993.

Barinaga, M.
"Confusion on the cutting edge." *Science.* 257(July 31):616–19. 1992.

Booth, W.
"Conflict of interest eyed at Harvard." *Science.* 242: 1988.

Bowie, N., and R. Duska.
Business Ethics. Prentice Hall. Englewood Cliffs, N.J. 1990.

Carson, T.
"Conflicts of interest." *Journal of Business Ethics.* 13:387–404. 1994.

Committee on Government Operations.
"Are scientific misconduct and conflicts of interest hazardous to our health?" *Union Calendar.* 430(Sept. 10):1–74. 1990.

Cordes, C.
"Debate flares over growing pressures on academe for ties with industry." *Chronicle of Higher Education.* (Sept. 16):A26–27, A29. 1992.

Cummings K. M., R. Sciandra, A. Gingrass, and R. Davis.
"What scientists funded by the tobacco industry believe about the hazards of cigarette smoking." *American Journal of Public Health.* 81(7):894–96. 1991.

Davis, M.
"Conflict of interest." *Business and Professional Ethics Journal.* 1:17–27. 1982.

Jackson, M. J.
"AAMC Papers: Guidelines for dealing with faculty conflicts of commitment & conflicts of interest in research." *Academic Medicine.* 65(7):489–96. 1990.

Koshland, D. E.
"Simplicity and complexity in conflict of interest." *Science.* 261(July 2):11. 1993.

Koshland, D. E.
"Journal policies on conflict of interest." *Science.* 261(Sept. 24):1661. 1993.

Luebke, N.
"Conflict of interest as a moral category." *Business and Professional Ethics Journal.* 6: 1987.

Marshall, E.
"When commerce and academe collide." *Science.* 248(April 13):152–56. 1990.

Marshall, E.
"Data sharing: A declining ethic." *Science.* 248:952–57. 1990.

Marshall, E.
"The perils of a deeply-held point of view." *Science.* 257:1992.

Porter, R. J., and T. E. Malone.
Biomedical Research: Collaboration and Conflict of Interest. Johns Hopkins University Press. Baltimore, Md. 1992.

Rothman, K. J.
"Journal policies on conflict of interest." *Science.* 261: 1993.

Rothman, K. J.
"Conflict of interest: The new McCarthyism in science." *Journal of the American Medical Association*. 269(21):2782–84. 1993.

Spece, R. G., D. S. Shimm, and A. E. Buchanan.
Conflicts of Interest in Clinical Practice and Research. Oxford Universty Press. New York. 1995.

Wells, P., H. Jones, and M. Davis.
Conflicts of Interest in Engineering. Kendall/Hunt. Dubuque, Iowa. 1985.

Animal Experimentation

American Psychological Association.
"Guidelines for ethical conduct in the care and use of animals." American Psychological Association. Washington, D.C. 1985.

Arluke, A.
"The ethical socialization of animal researchers." *Lab Animal*. (June):30–35. 1994.

Baylor College Office of Research.
"Guidelines for certain experimental procedures involving animals." Baylor College of Medicine. Houston, Tex. 1992.

Beauchamp, T. L.
"The moral standing of animals in medical research." *Law, Medicine & Health Care*. 20(1&2. Spring/Summer):7–16. 1992.

Bennett, B. T., M. J. Brown, and J. C. Schofield.
Essentials for Animal Research: A Primer for Research Personnel. National Agriculture Library. Beltsville, Md. 1994.

Caplan, A. L.
"Beastly conduct: Ethical issues in animal experimentation." *Annals New York Academy of Sciences*. 406:159–69. 1983.

Davis, H., and D. Balfour.
The Inevitable Bond: Examining Scientist-Animal Interactions. Cambridge University Press. Cambridge. 1992.

DeGrazia, D.
"The moral status of animals and their use in research: A philosophical review." *Kennedy Institute of Ethics Journal*. 1(1):48–70. 1991.

Harrison, P.
"Do animals feel pain?" *Philosophy*. 66:38. 1991.

Herzog, H. A.
"Perspectives on animal use: The moral status of mice." *ILAR News*. 31(1):4–7. 1989.

Hoff, C.
"Sounding board: Immoral and moral uses of animals." *New England Journal of Medicine*. 302(2):115–18. 1980.

Keefe, F., R. Fillingim, and D. Williams.
"Behavioral assessment of pain: Nonverbal measures in animals and humans." *ILAR News*. 33(1–2):3–13. 1991.

Machan, T.
"Do animals have rights?" *Public Affairs Quarterly.* 5(2):168. 1991.

Mishkin, B.
"On parallel tracks: Protecting human subjects and animals." *Hastings Center Report.* 15(5):32–43. 1985.

Nicoll, C. S., and S. M. Russell.
"Mozart, Alexander the Great, and the animal rights/liberation philosophy." *FASEB Journal.* 5:2888. 1991.

O'Neill, T., D. Bender, and B. Leone.
Biomedical Ethics, Opposing Viewpoints Series. Greenhaven Press. San Diego, Calif. 1994.

Orlans, F. B.
"Section V. Policy issues in the use of animals in research, testing, and education." *The Hastings Center Report.* (May/June):25–30. 1990.

Orlans, F. B.
In the Name of Science: Issues in Responsible Animal Experimentation. Oxford University Press. New York 1993.

Osgood, P.
"The assessment of pain in the burned child and associated studies in the laboratory rat." *ILAR News.* 33(2). 1991.

Pardes, H., A. West, and H. A. Pincis.
"Physicians and the animal-rights movement." *New England Journal of Medicine.* 324(23):1640–43. 1991.

Paton, W.
Man & Mouse: Animals in Medical Research. Second edition. Oxford University Press. Oxford. 1993.

Regan, T., and P. Singer.
Animal Rights and Human Obligations. Second edition. Prentice Hall. Englewood Cliffs, N.J. 1989.

Remfry, J.
"Ethical aspects of animal experimentation." In *Laboratory Animals: An Introduction for New Experimenters.* 5–21. A. A. Tuffery, ed. Wiley-Interscience Publication. Chichester. 1987.

Rollin, B. E., and L. M. Kesel.
The Experimental Animal in Biomedical Research. Vol. 1. CRC Press. Boca Raton, Fla. 1990.

Russow, L.
"Ethical theory and the moral status of animals." *Hastings Center Report.* (May/June)(Suppl.):54–58. 1990.

Sapontzis, S.
Morals, Reason, and Animals. Temple University Press. Philadelphia. 1987.

Smith, J. A., and K. M. Boyd.
Lives in the Balance: The Ethics of Using Animals in Biomedical Research. Oxford University Press. Oxford. 1991.

Smith, S. J., R. M. Evans, M. Sullivan-Fowler, and W. Hendee.
"Use of animals in biomedical research: The challenge and response." *Archives of Internal Medicine*. 148(8):1849–53. 1988.

Tannenbaum, J.
"The veterinarian and animal research." In *Veterinary Ethics*. 312–41. Williams & Wilkins. Baltimore, Md. 1989.

Tannenbaum, J.
"Ethics and animal welfare: The inextricable connection." *Journal of the American Veterinary Medical Association*. 198(8):1360–76. 1991.

Tannenbaum, J., and A. Rowan.
"Rethinking the morality of animal research." *Hastings Center Report*. 15(5):32–43. 1985.

Toth, L. A., and G. A. Olson.
"Strategies for minimizing pain and distress in laboratory animals." *Lab Animal*. (April):33–39. 1991.

U.S. Congress, Office of Technology Assessment.
Alternatives to Animal Use in Research, Testing, and Education. Washington, D.C. 1986.

Vance, R. P.
"An introduction to the philosophical presuppositions of the animal liberation/rights movement." *Journal of the American Medical Association*. 268:1715–19. 1992.

Verhetsel, E.
They Threaten Your Health: A Critique of the Antivivisectionist/Animal Rights Movement. Nutritional Information Center. Tucson, Ariz. 1986.

Human Experimentation

"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.

"Research involving patients. Summary and recommendations of a report of the Royal College of Physicians." *Journal of the Royal College of Physicians of London*. 24(1):10–14. 1990.

Annas, G. J., and M. A. Grodin.
The Nazi Doctors and the Nuremburg Code: Human Rights in Human Experimentation. Oxford University Press. New York. 1992.

Berger, A. L.
"Ethics in scientific communication: Study of a problem case." *Journal of Medical Ethics*. 20(4):207–11. 1994.

Blanck, P. D., A. S. Bellack, R. L. Rosnow, M. J. Rotherman-Borus, and N. R. Schooler.
"Scientific rewards and conflicts of ethical choices in human subjects research."
American Psychologist. 47(7):959–65. 1992.

Brett, A., and M. Grodin.
"Ethical aspects of human experimentation in health services research." *Journal of the American Medical Association*. 265(14):1854–57. 1991.

Byk, C.
"The European convention on bioethics." *Journal of Medical Ethics*. 19(March):13–16. 1993.

Caplan, A. L.
"Twenty years after. The legacy of Tuskegee Syphilis Study. When evil intrudes." *Hastings Center Report*. 22(Dec.):29–32. 1992.

Choudhry, S.
"Review of legal instruments and codes on medical experimentation with children." *Cambridge Quarterly Healthcare Ethics*. 3(4):560–72. 1994.

CIOMS/WHO.
International Ethical Guidelines for Biomedical Research Involving Human Subjects. CIOMS. Geneva. 1993.

Coller, B. S.
"The newly dead as research subjects." *Clinical Research*. 37(3):487–94. 1989.

Committee for the Protection of Human Participants in Research.
"Ethical principles in the conduct of research with human participants." 1–76. American Psychological Association. Washington, D.C. 1989.

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.

Dickens, B. M.
"Issues in preparing ethical guidelines for epidemiological studies." *Law, Medicine, and Health Care*. 19(Fall/Winter):175–83. 1991.

Dickens, B. M., L. Gostin, and R. J. Levine.
"Research on human populations: National and international ethical guidelines." *Law, Medicine, and Health Care*. 19(Fall/Winter):157–61. 1991.

Dicker, B. G., and D. L. Kent.
"Physician consent and researchers' access to patients." *Epidemiology*. 1(March):160–63. 1990.

Faden, R. R., T. L. Beauchamp, and N. M. P. King.
A History and Theory of Informed Consent. Oxford University Press. New York. 1986.

Fethe, C.
"Beyond voluntary consent: Hans Jonas on the moral requirements of human experimentation." *Journal of Medical Ethics*. 19(June):99–103. 1993.

Flournoy, N., and L. B. Hearne.
"Sharing scientific data III: Planning and the research proposal." IRB: *A Review of Human Subjects Research*. 12(May/June):6–9. 1990.

Freedman, B.
"Scientific value and validity as ethical requirements for research: A proposed explication." IRB: A *Review of Human Subjects Research*. 9(6):7–10. 1987.

Freedman, B., A. Fuks, and C. Weijer.
"Demarcating research & treatment: A systematic approach for the analysis of the ethics of clinical research." Clinical Research. 40(Dec.):653–60. 1992.

Freedman, B., A. Fuks, and C. Weijer.
"In loco parentis. Minimal risk as an ethical threshold for research upon children." *Hastings Center Report*. 23(April):13–19. 1993.

Freund, P. A.
Experimentation with Human Subjects. George Braziller. New York. 1969.

Fulford, K. W., and K. Howse.
"Ethics of research with psychiatric patients: Principles, problems and the primary responsibilities of researchers." *Journal of Medical Ethics*. 19(2):85–91. 1993.

Gamble, V. N.
"A legacy of distrust: African Americans and medical research." *American Journal of Preventative Medicine*. 9(6)(Suppl.):35–38. 1993.

Gostin, L.
"Ethical principles for the conduct of human subject research: Population-based research ethics." *Law, Medicine and Health Care*. 19(Fall/Winter):191–201. 1991.

Grodin, M. A., and L. H. Glantz.
Children as Research Subjects: Science, Ethics and the Law. Oxford University Press. New York. 1994.

Grodin, M. A., G. J. Annas, and L. H. Glantz.
"Medicine and human rights. A proposal for international action." *Hastings Center Report*. 23(4):8–12. 1993.

Johnson, N., R. J. Lilford, and W. Brazier.
"At what level of collective equipoise does a clinical trial become ethical?" *Journal of Medical Ethics*. 17(1):30–34. 1991.

Jonsen, A. A.
"The ethics of using human volunteers for high-risk research." *Journal of Infectious Diseases*. 160(2):205–8. 1989.

Juengst, E. T.
"The NIH 'points to consider' and the limits of human gene therapy." *Human Gene Therapy*. 1(4):425–33. 1990.

Koren, G., D. B. Carmeli, Y. S. Carmeli, and R. Haslam.
"Maturity of children to consent to medical research: The babysitter test." *Journal of Medical Ethics*. 19(3):142–47. 1993.

Koren, G., and A. Pastuszak.
"Medical research in infants and children in the eighties: Analysis of rejected protocols." *Pediatric Research*. 27(5):432–35. 1990.

Lane, L., C. K. Cassel, and W. Bennett.
"Ethical aspects of research involving elderly subjects: Are we doing more than we say?" *Journal of Clinical Ethics*. 1(4):278–85. 1990.

Lederor, S. E.
Subjected to Science: Human Experimentation in America Before the Second World War. Johns Hopkins Press. Baltimore, Md. 1995.

Levine, R. J.
Ethics and Regulation of Clinical Research. Second edition. Urban and Schwarzenberg. Baltimore, Md. 1986.

Levine, R. J.
"New international guidelines for research involving human subjects." *Annals of Internal Medicine*. 119(Aug. 15):339–41. 1993.

Lind, S. E.
"The institutional review board: An evolving ethics committee." *Journal of Clinical Ethics.* 3(4):278–82. 1992.

MacKay, C. R.
"Ethical issues in research design and conduct: Developing a test to detect carriers of Huntington's Disease." *IRB: A Review of Human Subjects Research.* 6(4):1–5. 1984.

Mastroianni, A., R. Faden, and D. Federman.
Women and Health Research: Ethical and Legal Issues of Including Women in Clinical Studies. Vol. 2. National Academy Press. Washington, D.C. 1994.

Meslin, E. M.
"Ethical issues in the substantive and procedural aspects of research ethics review." *Health Law in Canada.* 13:179–91. 1993.

Nowak, R.
"Problems in clinical trials go far beyond misconduct." *Science.* 264(June 10):1538–41. 1994.

Oddi, L. F., and V. A. Cassidy.
"Nursing research in the United States: The protection of human subjects." *International Journal of Nursing Studies.* 27(1):21–33. 1990.

Palmer, C. R.
"Ethics and statistical methodology in clinical trials." *Journal of Medical Ethics.* 19(4):219–22. 1993.

Passamani, E.
"Of mice but not men: Problems of the randomized clinical trial." *New England Journal of Medicine.* 324(22):1585–92. 1991.

Pellegrino, E. D.
"Beneficence, scientific autonomy, and self-interest: Ethical dilemmas in clinical research." *Cambridge Quarterly Healthcare Ethics.* 4(1):361–69. 1992.

Public Law.
"The Public Health Service Act as amended by the Heath Research Extension Act of 1985." Public Law 99-158. Section 492. Nov. 20. 1985.

Seachrist, L.
"Scientific misconduct. NIH tightens clinical trials monitoring." *Science.* 264(April 22):499. 1994.

Sheldon, M., W. P. Whitely, B. Folker, A. W. Hafner, and W. Gaylin.
"Nazi data: Dissociation from evil." *Hastings Center Report.* 19(4):16. 1989.

Sieber, J. E.
"Ethical considerations in planning and conducting research on human subjects." *Academic Medicine.* 68(9) (Suppl.):S9–13. 1993.

Siegler, M., S. Amiel, and J. Lantos.
"Scientific and ethical consequences of disease prediction." *Diabetologia.* 35(Dec.)(Suppl.): S-60–68. 1992.

Spicker, S. F., ed.
The Use of Human Beings in Research. Kluwer Academic. Boston. 1988.

Sutherland, H. J., E. M. Meslin, and J. E. Till.
"What's missing from current clinical trial guidelines?" *Journal of Clinical Ethics.* 5(4):297–303. 1994.

Turner, D. A., and W. Kearney.
"Scientific and ethical concerns in neural fetal tissue transplantation." *Neurosurgery*. 33(6)1031–37. 1993.

U.S. Department of Health and Human Services.
"World Medical Association Declaration of Helsinki." In *Protecting Human Subjects: Institutional Review Board Guidebook*. A6-3 to A6-6. OPRR/NIH. Washington, D.C. 1993.

U.S. NIH Office for Protection from Research Risks.
"Protecting human research subjects: Institutional review guidebook." U.S. Government Printing Office. Washington, D.C. 1993.

Engineering

Alger, P. L., N. A. Christensen, and S. P. Olmstead.
Ethical Problems in Engineering. John Wiley & Sons. New York. 1965.

Baker, M. A.
"Ethical and legal disputes involving corporate engineers." IEEE *Technology and Society Magazine*. (June 4):10–20. 1985.

Brantley, C. J.
"Survey of ethics code provisions by subject-matter area." American Association of Engineering Societies. Washington, D.C. 1988.

Brill, W. J.
"Why engineered organisms are safe." *Issues in Science and Technology*. 4(Spring):44–50. 1988.

Broome, T., Jr.
"The slippery ethics of engineering." *Washington Post*. (Dec. 28):D3. 1986.

Brown, F. K.
"Technical ethics." *Engineering Education*. 73(Jan.):298–300. 1983.

ElBaz, S.
Professional Ethics and Engineering: A Resource Guide. NIEE, NSPE. Alexandria, Va. 1990.

Flores, A., and R. J. Baum.
Ethical Problems in Engineering. Second edition. 2 Vols. Center for the Study of the Human Dimensions of Science & Technology, RPI. Troy, N.Y. 1980.

Florman, S.
Blaming Technology: The Irrational Search for Scapegoats. St. Martins Press. New York, N.Y. 1981.

Garvey, W.
Communication: The Essence of Science. Chapter 1. Pergamon Press. Oxford. 1979.

Gunn, A. S., and P. A. Vesilind.
Environmental Ethics for Engineers. Lewis Publishers. Chelsea, Mich. 1986.

Kipnis, K.
"Engineers who kill: Professional ethics and the paramountcy of public safety." *Business & Professional Ethics Journal*. 1(Fall):77–92. 1981.

Layton, E. T., Jr.
The Revolt of the Engineers: Social Responsibility and the American Engineering Profession. Johns Hopkins University Press. Baltimore, Md. 1986.

Luegenbiehl, H. C.
“Society as engineers’ client.” *Liberal Studies Educator*. 4:1–10. 1981–82.

Martin, M. W., and R. Schinzinger.
Ethics in Engineering. McGraw-Hill. New York, N.Y. 1989.

Mitcham, C.
“Industrial and engineering ethics: Introductory notes and annotated bibliography.” *Research in Philosophy and Technology*. 8:251–65. 1985.

National Association for Biomedical Research
“NABR Issue Update.” National Association for Biomedical Research. Washington, D.C. 1991.

Petroski, H.
To Engineer Is Human. St. Martin’s Press. New York. 1985.

Schaub, J. H., and K. Pavlovic.
Engineering Professionalism and Ethics. John Wiley. New York, N.Y. 1983.

Unger, S. H.
Controlling Technology: Ethics and the Responsible Engineer. Holt, Rinehart and Winston. New York, N.Y. 1982.

Weil, V.
“Moral issues in engineering: An engineering school instructional approach.” *Professional Engineer*. 47(Oct.):35–37. 1977.

Weil, V.
“Ethics in engineering curricula.” *Research in Philosophy and Technology*. 8:243–50. 1985.

Weil, V.
Engineering Ethics in Engineering Education. Summary Report of a Conference, June 12–13, 1990. Illinois Institute of Technology. Chicago. 1992.

Whitbeck, C.
“The engineer’s responsibility for safety: Integrating ethics teaching into courses in engineering design.” Presented at the ASME winter annual meeting (Dec. 13–18). Boston, Mass. 1987.

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 Aarne 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.

Author Index

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AAMC Ad Hoc Comittee. 1982. Institutional Responsibility.
AAMC Ad Hoc Committee on Misconduct. 1993. Conflict of Interest.
AAMC Ad Hoc Committee on Misconduct. 1990. Conflict of Interest.
Abu-hadid, M. 1991. Imanishi-Kari/Baltimore.
Adler, T. 1994. Human Radiation Experiments. (2).
Alger, P. 1965. Engineering.
Amato, I. 1992. Other.
American Chemical Society. 1994. Reporting.
Anderson, A. 1992. Other.
Anderson, A. 1990. Gallo. (2).
Anderson, C. 1990. Gallo. (2).
Anderson, C. 1990. Methodology.
Anderson, C. 1991. Imanishi-Kari/Baltimore.
Anderson, C. 1992. Other.
Anderson, C. 1993. Conflict of Interest. (2).
Anderson, C. 1993. Gallo. (4).
Anderson, C. 1993. Imanishi-Kari/Baltimore.
Anderson, C. 1993. Institutional Responsibility.
Anderson, C. 1993. Methodology.
Anderson, C. 1993. Other. (5).
Anderson, C. 1994. Institutional Responsibility.
Anderson, C. 1994. Methodology.
Anderson, M. 1994. Institutional Responsibility.
Angler, N. 1988. Other.
Annas, G. 1992. Human Experimentation.
Arluke, A. 1994. Animal Experimentation.
Associated Press. 1988. Other.
Association of American Universities. 1993. Conflict of Interest.

Babbage, C. 1830. General.
Baenen, L. 1993. General.
Bailar, J. C. 1985. Funding and Peer Review.
Bailar, J. C. 1986. Methodology.
Bailar, J. C. 1990. Reporting.
Bailar, J. C. 1992. Methodology.
Baird, L. 1990. Teaching and Learning.
Baker, D. 1986. Challenger.
Baker, M. 1985. Engineering.
Baltimore, D. 1989. Imanishi-Kari/Baltimore.

Baltimore, D. 1991. Imanishi-Kari/Baltimore. (2).
Barber, A. 1990. General.
Barbour, I. 1980. General.
Barinaga, M. 1991 General.
Barinaga M. 1992. Conflict of Interest.
Baum, R. J. 1983. Institutional Responsibility.
Baumrind, D. 1964. Milgram.
Baylor College. 1992. Animal Experimentation.
Beardsley, T. 1995. Human Radiation Experiments.
Beauchamp, T. L. 1992. Animal Experimentation.
Bebeau, M. 1991. Teaching and Learning.
Bebeau, M. 1995. General.
Bechtel, H. 1984. Methodology.
Bell, T. E., Challenger. 1987.
Benditt J. 1995. General.
Bennett, B. T. 1994. Animal Experimentation.
Berger, A. 1994. Human Experimentation.
Bird, S. J. 1995. Methodology.
Bishop, J. M., 1993. Funding and Peer Review.
Blanck, P. 1992. Human Experimentation.
Bland, C. J. 1986. General.
Blumenstyk, G. 1993. Other.
Bok, D. 1982. Teaching and Learning.
Bok, S. 1982. General.
Boone, C. 1982. Whistleblowing.
Booth, W. 1988. Conflict of Interest.
Bor, J. 1995. Gallo.
Bower, B. 1986. Challenger.
Bowie, N. 1990. Conflict of Interest.
Brand, D. 1987. Other.
Brantley, C. 1988. Engineering.
Brett, A. 1991. Human Experimentation.
Brill, W. 1988. Engineering.
Broad, W. J. 1981. Methodology.
Broad, W. J. 1981. Reporting.
Broome, T., Jr. 1986. Engineering.
Brown, F. 1983. Engineering.
Bulger, R. 1993. General.
Burnham, J. 1987. Reporting.
Bush, V. 1980. General.

Buzzelli, D. 1992. Institutional Responsibility.
Buzzelli, D. 1993. Institutional Responsibility. (2).
Buzzelli, D. 1994. Institutional Responsibility.
Byk, C. 1993. Human Experimentation.

Callahan, D. 1980. Teaching and Learning.
Caplan, A. 1983. Animal Experimentation.
Caplan, A. 1992. Human Experimentation.
Carrow, R. P. 1989. Funding and Peer Review.
Carson, T. 1994. Conflict of Interest.
Chalk, R. 1988. General.
Chalk, R. 1989. General.
Chalmers, A. F. 1982. General.
Chandler, D. 1989. Cold Fusion. (2)
Charles, D. 1991. Gallo.
Charrow, R. 1992. Institutional Responsibility.
Charrow, R. 1993. Institutional Responsibility.
Cheyney, D. 1993. General.
Choudhry, S. 1994. Human Experimentation.
Chubin, D. 1985. Methodology.
Chubin, D. E. 1990. Institutional Responsibility.
Chubin, D. E. 1990. Funding and Peer Review.
CIOMS/WHO. 1993. Human Experimentation.
Cohen, J. 1992. Gallo. (2).
Cohen, J. 1992. Other.
Cohen, J. 1993. Other.
Cohen, J. 1994. Gallo.
Cohen, J. 1994. Other.
Cohn, V. 1989. Reporting.
Coller, B. 1989. Human Experimentation.
Committee for the Protection of Human Participants in Research. 1989. Human Experimentation.
Committee on Academic Responsibility. 1992. General.
Committee on Government Operations. 1990. Conflict of Interest.
Commission on Research Integrity. 1995. Institutional Responsibility.
Committee on Science, Engineering, and Public Policy. 1995. General.
Connolly, T. 1983. General.
Cooke, R. 1991. General.
Cordes, C. 1992. Conflict of Interest.
Council of Biological Education Style Manual Committee. 1983. Reporting.
Council on Ethical and Judicial Affairs/Council on Scientific Affairs. 1989. Methodology.
Cranberg, L. 1992. Reporting.

Crawford, M. 1989. Cold Fusion.
Crewdson, J. 1989. Gallo.
Crewdson, J. 1991. Gallo.
Crigger, B. 1994. Human Radiation Experiments.
Croll, R. 1984. Reporting.
Crossen, C. 1991. Methodology.
Culliton, B. 1988. Imanishi-Kari/Baltimore. (2).
Culliton, B. 1989. Imanishi-Kari/Baltimore.
Culliton, B. J. 1990. Gallo. (5).
Culliton, B. 1991. Institutional Responsibility.
Culliton, B. 1994. Institutional Responsibility.
Cummings, K. M. 1991. Conflict of Interest.
Curd, M. 1984. General.
Cutcliffe, S. H. 1980. General.

Darling, L. 1986. Teaching and Learning.
Davis, H. 1992. Animal Experimentation.
Davis, M. 1982. Conflict of Interest.
Davis, M. 1990. Teaching and Learning.
Day, R. 1994. Reporting.
DeDeyn, P. 1994. General.
DeForest, P. 1988. General.
DeGeorge, R. T. 1981. Other.
DeGrazia, D. 1991. Animal Experimentation.
Department of Health and Human Services. 1985. Institutional Responsibility.
Department of Health, Education, and Welfare. 1979. Human Experimentation.
Devine, T. 1988. Whistleblowing.
Diamond, G. 1990. Methodology.
Dickens, B. 1991. Human Experimentation. (2).
Dicker, B. 1990. Human Experimentation.
Diener, E. 1979. General.
Dingell, J. 1992. Methodology.
Djerassi, C. 1989. General.
Doty, P. 1991. Imanishi-Kari/Baltimore.
Downie, R. S. 1971 General.
Draper, E. 1991. General.
Durbin, P. 1992. General.

Edsall, J. 1991. Imanishi-Kari/Baltimore.
Ehrenreich, B. 1991. Imanishi-Kari/Baltimore.

Eisen, H. 1991. Imanishi-Kari/Baltimore.
Eisner, R. 1991. Institutional Responsibility.
ElBaz, S. 1990. Engineering.
Elliott, D. 1996. General.
Endocrine Society Publications Committee. 1993. Reporting.
Engelhardt, H. T. 1978. General.
Engler, R. 1983. General.
Erwin, E. 1994. General.
Estling, R. 1995. Human Radiation Experiments.
Ezzell, C. 1993. Gallo.

Faden, R. 1986. Human Experimentation.
Faden, R. 1996. Human Radiation Experiments.
Fernie, J. D. 1995. Other.
Fethe, C. 1993. Human Experimentation.
Fielder, J. 1992. Other.
Fienberg, S. 1990. Methodology.
Flores, A. 1980. Engineering.
Florman, S. 1981. Engineering.
Flournoy, N. 1990. Human Experimentation.
Fogle, P. W. 1992. Cold Fusion.
Franklin, A. 1986. General.
Freedman, B. 1987. Human Experimentation.
Freedman, B. 1992. Human Experimentation.
Freedman, B. 1993. Human Experimentation.
Freund, P. A. 1969. Human Experimentation.
Friedly, J. 1996. Other.
Friedman, P. 1988. Institutional Responsibility.
Friedman, P. 1992. Methodology.
Fry, S. 1990. Institutional Responsibility.
Fulford, K. 1993. Human Experimentation.

Gallo, R. 1991. Gallo.
Gamble, V. 1993. Human Experimentation.
Garvey, W. 1979. Engineering.
Gert, B. 1988. General.
Gert, B. 1989. General.
Gibbons, A. 1992. Other.
Gladwall, M. 1991. Gallo.
Glazer, M. P. 1989. Whistleblowing.
Goodstein, D. 1991. Methodology.

Gosling, D. 1985. Teaching and Learning.
Gostin, L. 1991. Human Experimentation.
Gould, S. 1981. General.
Government Accountability Project. 1989. Whistleblowing.
Greenberg, D. 1989. Institutional Responsibility.
Greenberg, D. 1987. Other.
Greenberg, D. 1994. Gallo.
Grinnell, F. 1987. General.
Grodin, M. 1994. Human Experimentation.
Grodin, M. A. 1993. Human Experimentation.
Guinan, M. E. 1992. General.
Gunn, A. 1986. Engineering.
Gunsalus, C. 1992. Institutional Responsibility.
Gunsalus, C. 1993. Institutional Responsibility.

Hacket, E. 1990. Teaching and Learning.
Hall, N. 1989. Cold Fusion.
Halperin, E. C. 1992. Reporting.
Hamilton, D. 1991. Gallo.
Hamilton, D. 1991. Imanishi-Kari/Baltimore. (6)
Hamilton, D. 1992. Gallo.
Hanson, S. M. H. 1988. Reporting.
Harrison, P. 1991. Animal Experimentation.
Hastings Center. 1980. Teaching and Learning.
Herman, K. G. 1994. Institutional Responsibility.
Herzog, H. 1989. Animal Experimentation.
Hilts, P. 1992. Imanishi-Kari/Baltimore.
Hilts, P. 1994. Institutional Responsibility.
Hilts, P. J. 1993. Gallo.
Hodge, S. 1981. Reporting.
Hoff, C. 1980. Animal Experimentation.
Holden, C. 1987. Other. (2).
Holden, C. 1991. Other.
House Committe on Science and Technology. 1986. Challenger. (2).
House Committee on Science, Space and Technology. 1987. Challenger.
Huber, B. T. 1991. Imanishi-Kari/Baltimore.
Huizenga, J. R. 1992. Cold Fusion.
Hull, D. 1988. General.
Huth, E. J. 1986. Reporting.

Imanishi-Kari, T. 1991. Imanishi-Kari/Baltimore. (2).

Institute of Medicine Committee on the Responsible Conduct of Research. 1989. Institutional Responsibility.
International Committee of Medical Journal Editors.1985. Reporting.
International Committee of Medical Journal Editors.1991. Reporting.

Jackson, I. 1986. General.
Jackson, M. J. 1990. Conflict of Interest.
Jasanoff, S. 1993. General.
Jensen, C. 1996. Challenger.
Johnson, D. 1990. Institutional Responsibility.
Johnson, N. 1991. Human Experimentation.
Jones, J. 1993. Other.
Jones, P. 1986. Challenger.
Jonsen, A. 1989. Human Experimentation.
Joyce, C. 1986. Challenger. (3).
Juengst, E. 1990. Human Experimentation.

Kaiser, J. 1995. Institutional Responsibility (2).
Kassirer, J. 1993. Methodology.
Keefe, F. 1991. Animal Experimentation.
Kimmel, A. J. 1988. General.
Kipnis, K. 1981. Engineering.
Kistiakowsky, V. 1989. Funding and Peer Review.
Kitcher, P. 1993. General.
Kohn, A. 1991. Reporting.
Kohn, P. M. 1980. Other.
Koren, G. 1990. Human Experimentation.
Koren, G. 1993. Human Experimentation.
Korenman, S. 1994. General.
Koshland, D. 1991. Imanishi-Kari/Baltimore.
Koshland, D. 1991. Reporting.
Koshland, D. E. 1993. Conflict of Interest. (2).
Kuhn, T. 1970. General.
Kurfiss, J. 1983. Teaching and Learning.
Kuznik, F. 1991. Imanishi-Kari/Baltimore.

LaFollette, M. 1992. Reporting.
Lal, G. 1945. General.
Lane, L. 1990. Human Experimentation.
Lanken, P. N. 1995. Reporting. (2).
Latour, B. 1986. Methodology.

Laudan, L. 1990. General.
Layton, E.T. 1986. Engineering.
Loederer, S. E. 1995. Human Experimentation.
Levine, R. 1986. Human Experimentation.
Levine, R. 1993. Human Experimentation.
Lind, S. 1992. Human Experimentation.
Lindley, D. 1992. Cold Fusion.
Littlejohn, M. 1989. Institutional Responsibility.
Lock, S. 1993. Methodology.
Loevinger, L. 1991. Imanishi-Kari/Baltimore.
Longino, H. 1990. General.
Luebke, N. 1987. Conflict of Interest.
Luegenbiehl, H. C. 1981–82 Engineering.

Machan, T. 1991. Animal Experimentation.
Macilwain, C. 1994. Human Radiation Experiments. (2).
MacIntosh, N. J. 1995. Methodology.
MacKay, C. 1984. Human Experimentation.
Macrina, F. 1993. Teaching and Learning.
Macrina, F. 1995. General.
Maddox, J. 1991. Imanishi-Kari/Baltimore.
Mallove, E. 1991. Cold Fusion.
Mann, C. C. 1994. Human Radiation Experiments.
Marshall, E. 1986. Challenger.
Marshall, E. 1990. Conflict of Interest. (2).
Marshall, E. 1991. Other.
Marshall, E. 1992. Conflict of Interest.
Marshall. E. 1992. Other.
Marshall, E. 1993. Institutional Responsibility.
Marshall, E. 1994. Funding and Peer Review. (2).
Martin, M. 1989. Engineering.
Martin, R. 1991. General.
Marx, J. L. 1984. Gallo.
Mastroianni, A. 1994. Human Experimentation.
Matthysse, S. 1984. Funding and Peer Review.
Mazur, A. 1989. Institutional Responsibility.
McCutchen, C. W. 1991. Funding and Peer Review.
McDevitt, H. 1991. Imanishi-Kari/Baltimore.
McDonald, K. A. 1991. Cold Fusion.
Medawar, P. 1984. General.
Medvedev, G. 1990. Other.

Mele, C. 1990. Other.
Merriam, S. 1987. Teaching and Learning.
Merton, R. K. 1968. Reporting.
Mervis, J. 1989. Other.
Mervis, J. 1995. Imanishi-Kari/Baltimore.
Meslin, E. 1993. Human Experimentation.
Milgram S. 1975. Milgram.
Milgram, S. 1983. Milgram.
Miller, A. G. 1986. Milgram.
Miller, D. J. 1992. General.
Mishkin, B. 1985. Animal Experimentation.
Mishkin, B. 1991. Institutional Responsibility.
Mishkin, B. 1992. Institutional Responsibility.
Mitcham, C. 1985. Engineering.

National Aeronautics and Space Administration. 1986. Challenger.
National Academy of Science. 1992. General.
National Institutes of Health. 1993. Methodology.
Nelkin, D. 1984. General.
Nelkin, D. 1987. Reporting.
Nicoll, C. 1991. Animal Experimentation.
Norman, C. 1985. Gallo.
Norman, C. 1986. Gallo.
Nowak, R. 1994. Human Experimentation.

Office of Inspector General. 1993. Institutional Responsibility.
Oddi, L. 1990. Human Experimentation.
Olson, S. 1989. General.
O’Neill, T. 1994. Animal Experimentation.
Orlans, F. B. 1990. Animal Experimentation.
Orlans, F. B. 1993. Animal Experimentation.
Osgood, P. 1991. Animal Experimentation.
O’Toole, M. 1991. Imanishi-Kari/Baltimore. (3).

Palca, J. 1991. Gallo. (4).
Palmer, C. 1993. Human Experimentation.
Panel on Scientific Responsibility and the Conduct of Research. 1993. Institutional Responsibility.
Pardes, H. 1991. Animal Experimentation.
Parker, D. B. 1978. General.
Passamani, E. 1991. Human Experimentation.
Paton, W. 1993. Animal Experimentation.

Patten, S. C. 1977. Milgram.
Pellegrino, E. 1992. Human Experimentation.
Penslar, R. 1995. General.
Perry, T. 1981. General.
Petersdorf, R. G. 1986. General.
Petroski, H. 1985. Engineering.
Piper, T. 1993. Teaching and Learning.
Pool, R. 1988. Other.
Poon, P. 1995. Whistleblowing.
Porter, R. 1992. Conflict of Interest.
Ptashne, M. 1991. Imanishi-Kari/Baltimore.
Public Law. 1985. Human Experimentation.

Quinn, D. 1992. General.

Racker, E. 1989. Methodology.
Raloff, J. 1994. Human Radiation Experiments.
Rayl, A. 1991. Methodology.
Regan, T. 1989. Animal Experimentation.
Reiser, S. 1993. Teaching and Learning.
Relman, A. S. 1990. Reporting.
Remfry, J. 1987. Animal Experimentation.
Rest, J. R. 1979. Teaching and Learning.
Rest, J. R. 1986. Teaching and Learning.
Rest, J. R. 1988. Teaching and Learning.
Rhoades, L. J. 1990. Methodology.
Roberts, L. 1991. Other.
Roberts, L. 1992. Other. (2).
Rollin, B. 1990. Animal Experimentation.
Rossiter, E. J. R. 1992. Other.
Rostand, J. 1960. Methodology.
Rothman, K. J. 1993. Conflict of Interest. (2).
Rubenstein, A. 1989. Teaching and Learning.
Rubinstein, E. 1990. Gallo.
Rubinstein, E. 1991. Gallo.
Russell, L. 1994. Methodology.
Russow, L. 1990. Animal Experimentation.

Sachs, G. 1993. Teaching and Learning.
Saltus, R. 1991. Imanishi-Kari/Baltimore.
Saltus, R. 1989. Cold Fusion.

Sapontzis, S. 1987. Animal Experimentation.
Sarasohn, J. 1993. Imanishi-Kari/Baltimore.
Sawyer, K. 1991. Other.
Schachman, H. 1993. Institutional Responsibility.
Schaub, J. 1983. Engineering.
Schmaus, W. 1983. Methodology.
Schwartz, C. 1989. General.
Seachrist, L. 1994. Human Experimentation.
Segerstedt, T. 1979. General.
Segerstrale, U. 1990. Methodology.
Shapiro, B. 1984. Teaching and Learning.
Sheldon, M. 1989. Human Experimentation.
Shrader-Frechette, K. 1994. General.
Sieber, J. 1992. General.
Sieber, J. E. 1993. Human Experimentation.
Siegler, M. 1992. Human Experimentation.
Sigma Xi. 1993. General.
Smith, A. 1978. General.
Smith, J. A. 1991. Animal Experimentation.
Smith, R. J. 1986. Challenger. (5).
Smith, S. J. 1988. Animal Experimentation.
Soyfer, V. N. 1989. Other.
Spece, R. G. 1995. Conflict of Interest.
Spicker, S. 1988. Human Experimentation.
Stanley, B. 1987. General.
Stewart, W. 1991. Imanishi-Kari/Baltimore.
Stipp, D. 1985. Methodology.
Stone, R. 1993. Other.
Stone, R. 1994. Imanishi-Kari/Baltimore.
Stone, R. 1994. Institutional Responsibility.
Subcommittee on the Civil Services. 1992. Whistleblowing.
Sutherland, H. 1994. Human Experimentation.
Swazey, J. 1981. Whistleblowing.
Swazey, J. 1989. Teaching and Learning.
Swazey, J. 1993. Teaching and Learning.
Szklo, M. 1991. Reporting.

Talent, J. A. 1989. Other.
Tannenbaum, J. 1985. Animal Experimentation.
Tannenbaum, J. 1989. Animal Experimentation.
Tannenbaum, J. 1991. Animal Experimentation.

Taubes, G. 1991. Other.
Taubes, G. 1993. Cold Fusion.
Taubes, G. 1993. Funding and Peer Review.
Taubes, G. 1993. Methodology.
Taubes, G. 1994. Other.
Taubes, G. 1995. Reporting.
Teich, A. 1992. Institutional Responsibility.
Toth, L. 1991. Animal Experimentation.
Trento, J. J. 1987. Challenger.
Trow, M. 1976. Teaching and Learning.
Turner, D. A. 1993. Human Experimentation.

Unger, S. 1982. Engineering.
U.S. Committee on Science, Space, and Technology. 1990. Whistleblowing.
U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations. 1989. Institutional Responsibility.
U.S. Congress, House of Representatives, Committee on Energy and Commerce, Subcommittee on Oversight and Investigations. 1990. Institutional Responsibility.
U.S. Congress, House of Representatives, Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight. 1990. Institutional Responsibility.
U.S. Congress, Office of Technology Assessment. 1986. Animal Experimentation.
U.S. Congress, Office of Technology Assessment. 1993. Institutional Responsibility.
U.S. Department of Health and Human Services. 1993. Human Experimentation.
U.S. Department of Public Health and Human Services. 1993. Institutional Responsibility. (2).
U.S. Department of Public Health and Human Services. 1995. Institutional Responsibility.
U.S. NIH Office for Protection from Research Risks. 1993. Human Experimentation.
U.S Senate Subcommittee on Science, Technology and Space. 1986. Challenger.
Vance, R. 1992. Animal Experimentation.
Vaughan, D. 1996. Challenger.
Velasquez, M. 1992. Teaching and Learning.
Verhetsel, E. 1986. Animal Experimentation.

Waldrop, M. M. 1986. Challenger.
Weaver, D. 1986. Imanishi-Kari/Baltimore.
Weaver, D. 1988. Imanishi-Kari/Baltimore.
Weil, V. 1977. Engineering.
Weil, V. 1983. Whistleblowing.
Weil, V. 1985. Engineering.
Weil, V. 1992. Engineering.
Weiss, P. 1989. Methodology.
Wells, P. 1985. Conflict of Interest.

Wheeler, D. 1992. Institutional Responsibility.
Whitbeck, C. 1987. Engineering.
Whitbeck, C. 1995. General.
Whitehouse, D. 1987. Challenger.
Widnall, S. 1988. Institutional Responsibility.
Woolf, P. 1988. Methodology.

Zuckerman, H. 1977. Methodology.
Zurer, P. 1991. Other.
Zwolenik, J. J. 1992. Institutional Responsibility.
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Scientific ethics calls for honesty and integrity in all stages of scientific practice, from reporting results regardless to properly attributing collaborators. This system of ethics guides the practice of science, from data collection to publication and beyond.Â Many of the ethical principles in science relate to the production of unbiased scientific knowledge, which is critical when others try to build upon or extend research findings. The open publication of data, peer review, replication, and collaboration required by the scientific ethic all help to keep science moving forward by validating research findings and confirming or raising questions about results (see our module Scientific Literature for further information). Although she recognizes researchers obligation to do scrupulous and un-biased research, she argues that other obligations may be no less weighty, and thatnonscientific obligations may appropriately inform the practice of scientific research. 242 ETHICS AND THE ENVIRONMENT Vol. 4, No. 2, 1999 Some will find this a surprising and counterintuitive position: many scientists andwriters on research ethics accept Jacques Monods view that objectivity in the re-search process is the only obligation of scientists (p. 50). The motive for this minimal-ist view is not difficult to find: One might worry tha Ethical lapses in research can significantly harm human and animal subjects, students, and the public. For example, a researcher who fabricates data in a clinical trial may harm or even kill patients, and a researcher who fails to abide by regulations and guidelines relating to radiation or biological safety may jeopardize his health and safety or the health and safety of staff and students. Codes and Policies for Research Ethics. Given the importance of ethics for the conduct of research, it should come as no surprise that many different professional associations, government agencies, and uni