Teaching Research Ethics: An Overview[1]

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Introduction

The current era of education in research ethics can be said to have dawned in 1989, when the National Institutes of Health (NIH) announced a "Requirement for programs on the responsible conduct of research [RCR] in National Research Service Award Institutional Training Programs" requiring that "a program in the principles of scientific integrity be an integral part of the proposed research training effort."[2]

The most recent update to this requirement lists the following subject matter:

a) conflict of interest—personal, professional, and financial

b) policies regarding human subjects, live vertebrate animal subjects in research, and safe laboratory practices

c) mentor/mentee responsibilities and relationships

d) collaborative research including collaborations with industry

e) peer review

[1] Adapted from a presentation made at a workshop on Research and Environmental Ethics Issues, Institute of Preventive and Clinical Medicine, Bratislava, Slovak Republic, April 1998.
[2] *NIH Guide for Grants and Contracts* 18(45), December 22, 1989, p. 1. Available at http://grants1.nih.gov/grants/guide/historical/1989_12_22_Vol_18_No_45.pdf (link verified Feb. 25, 2011). The requirement became effective July 1, 1990.

f) data acquisition and laboratory tools; management, sharing and ownership

g) research misconduct and policies for handling misconduct

h) responsible authorship and publication

i) the scientist as a responsible member of society, contemporary ethical issues in biomedical research, and the environmental and societal impacts of scientific research[3]

This is a daunting program of apparently heterogeneous elements. Who could blame a researcher for despairing about making sense of it all, let alone teaching it?

To try and make things more manageable, I suggest that it is useful to think about what is at stake in all of these areas. After much consideration, I believe that most—possibly all—concerns in the responsible conduct of research can be understood more readily under three key headings: the accuracy and adequacy of the record, fairness in research relationships; and the implications of research, for good and ill, for research, society, and beyond. By way of shorthand, I condense these three basic concerns into three simple questions about the processes and products of research: (1) Is it true?[4] (2) Is it fair? (3)Is it wise?

"Is it true?" concerns the relationship between actual observations or measurements and the reported results. Do the published data and conclusions drawn from them accurately and

[3] "Update on the requirement for instruction in the responsible conduct of research," November 24, 2009. Available at http://grants1.nih.gov/grants/guide/notice-files/NOT-OD-10-019.html (link verified Feb 25, 2011).
[4] The metaphysical concept of "truth" is highly contested and beyond the scope of this essay. For what it's worth, I, myself, am committed to the stance that there is such a thing as truth; that statements and claims can be characterized as being true, untrue, partially true, or outside the realm of truth (jokes and greetings, for example); and that we can have varying degrees of confidence of our estimation of the truth-value of a given statement, from *very low* to *good enough for all practical purposes* to *very high*.

adequately correspond to what the researchers observed or measured? If data are made up (fabricated) or fixed up (falsified), they are not true.

"Is it fair?" concerns the relationship between the research process and the social world. In this category belong issues such as authorship, plagiarism, and informed consent. For example, human subjects research can be true even if the data is gained without informed consent—unfairly.

"Is it wise?" concerns the relationship between the research agenda and the present and future world. Will the research lead to a better world, or a worse one? Would we be better off pursuing one line of research rather than another? What are the best mechanisms for distributing research funds? We have finite time and money for pursuing research, and the wisdom of research programs is a very valid question in research ethics.

The three questions are progressively more difficult to deal with and to teach. Although there might be specific cases in which valid manipulation of data can be hard to distinguish from invalid manipulation, there's no doubt that fabrication and falsification are completely unacceptable. Fairness is harder for the same reason sociology is less exact than chemistry: It's a messier realm and harder to contain. Wisdom is the most difficult because the wise course must be discerned and put into action. Enactment can be tremendously difficult because it requires cooperation from many individuals and institutions.

Research ethics in context

The obvious and natural place to teach research ethics is in the context of research—in the lab, or its equivalent.

Let me give an example. When I took chemistry as a first-year college student, I was taught that my lab notebook was to be kept a certain way: It had to be in a bound notebook; it had to be written in ink; every entry had to be dated; I was not allowed to erase anything or tear out a page; if I crossed anything out, I had to make a notation explaining why I had crossed it out; and so on. At the time, these restrictions taught me a very clear lesson about the conduct of research: Scientists are not allowed to make mistakes. Fear of making mistakes made me dislike chemistry lab, and it led many of my classmates to cheat.[5]

My teacher missed a very good opportunity to teach me something important about science and, simultaneously, about research ethics. I understand now that the strictures on keeping a notebook are intended to ensure an accurate historical record of my research, as it actually happened—mistakes and all —in detail, with no details lost or crossed out. I had to record what actually happened *right then*, not what I later remembered had happened when I finally got around to making my notes two days later, or what I wished had happened, or what I realized later I should have done. *What I wished had happened* had no place in my notebook (except, perhaps, under the heading, "What I wish had happened"); *what I should have done* is the fodder for the next experiment.

[5] I had a double major in math and English. Mathematicians value rigor and precision as much as any scientist, but mathematicians are always making mistakes, erasing, correcting, and moving on.

My teacher introduced me to a very good method for keeping a notebook, but he taught it as a set of rules to be learned and followed by rote, and this did not serve me well. Given the reasons behind the rules, I would have been more relaxed and involved in the lab and would have been able to see it as a learning experience rather than a test of my capacity for obsessive-compulsive behavior.

Teaching how to do science and how to do science ethically can be and should be part of the same process; it need not be an add-on, it need not take (much) extra time. It does take some attention on the part of the teacher, though, for if one teaches the rules of notebook keeping without teaching why those rules exist, the wrong lesson can be taught. I suspect the same is true for many other aspects of scientific research.

Research ethics everywhere

Not all aspects of research ethics can be taught during the actual practice of research, however, so I will briefly survey other possibilities by trying to answer the following questions:

- Who should be taught?
- What settings are appropriate for teaching?
- When should it be taught?
- Who should teach it?

I can give a short answer to all of these questions. Everyone involved in science should be taught the responsible conduct of science in every course, in every setting possible, at every level of education, by every responsible teacher of science.

This comprehensive scope reflects the vital importance of scientific research today. Science touches everyone's life nowadays, and the responsible conduct of research concerns everyone. Public money funds most research. Anyone who can be taught anything about research can be taught something about the responsible conduct of that research. No one is too experienced to learn more. Research and research ethics are not static; they are dynamic, constantly changing, and should be constantly evaluated, and cannot be learned once and for all. New research areas arise with novel ethical questions in tow; conditions change, such as awareness of global climate change, and both research and the ethics of that research must respond; social values shift and science, being embedded in society and social institutions, must be engaged. Changes often require reappraisal on many levels; reappraisal of responsible conduct must not be ignored, and that reappraisal should be disseminated, taught, and learned, even when consensus has not yet been reached.

Who should be taught the responsible conduct of research?

For some of the following categories, it might not be obvious what could be taught about research ethics; for them I have added a suggestion or two.

- K-6 students could be taught the importance of honesty and accuracy in recording observations and the potential of learning from mistakes

- High school students can be taught something about the context of the science they study—in chemistry, the importance of proper disposal of chemicals for the sake of the environment; in biology, how and why attitudes have changed in dissecting animals in class
- Undergraduate students
- Graduate students
- Postdoctoral fellows
- Junior researchers
- Senior researchers
- Laboratory technicians
- Research administrators
- Journal editors need to be vigilant for fabricated and falsified data (including doctored images) but also sensitive to the ambiguity inherent in the practice of science
- Peer reviewers have to adhere to high standards of confidentiality and objectivity, and researchers should realize their indebtedness to the peer review process and do their fair share
- Policy makers should be able to tell science from pseudo-science and act accordingly
- Informed citizens should understand that science is the best source of knowledge of the natural world that we have, but that science is a process that unfolds over time; and take popular media reports about science with a grain of salt

In short, everyone involved in the research process has something to learn about ethics.

What settings are appropriate for teaching research ethics?

By now you know my answer: In every possible forum. But let me list a few. Research ethics can be taught:

- As part of required undergraduate courses for students not majoring in science.
- As the focus of senior-level (final year) undergraduate courses for science majors (capstone courses).
- As part of introductory graduate courses, such as methods courses.
- As the focus of a course for graduate students, possibly across disciplines.
- As an occasional part of laboratory meetings.
- As an occasional part of departmental seminars.
- As an informal, but scheduled, series of meetings for graduate students and faculty members, perhaps over lunch.
- As an occasional campus-wide lecture by an outside speaker.
- As a series of campus-wide presentations on topics cutting across disciplines.
- As an annual half-day or full-day meeting sponsored by the Vice President for Research.

The list could go on, limited only by your imagination and resources. But this list must also raise some questions:

- Should it be graded? Pass/fail? Based on attendance only? Based on attendance and participation? Based on some kind of substantive learning?
- Should it be for credit? What kind of credit—elective or core credit toward a major?

Again there's a short answer to all of these questions: Yes. All of these are appropriate, depending on the setting. The key variable is often practicality. Would the faculty rise up in

revolt if you suggested adding a full, graded, required, core course on research ethics for all science majors? If so, don't suggest that; suggest something less ambitious.

This is an important point. Science and medical school curricula are tight. Finding time and personnel to teach research ethics can be difficult. But it is worth the effort, and any start, no matter how modest, is better than nothing. I like to tell people never to underestimate the power of the ripple effect. You are interested in research ethics; perhaps no one else in your department or university thinks it is worth teaching. But if you make the effort to raise these issues with students, even in an informal and small way, those students will talk to other students about it, and other faculty members will hear about it, and it will become apparent—so I have heard time and again—that students are very interested in and concerned about these issues. In time, student demand will grow, other faculty members will become interested, funding and time in the curriculum will be found.

When should the responsible conduct of research be taught?

Answers to this question are both implicit and explicit in what I've said so far. Let me speak to a limited situation: Suppose you can introduce research ethics into the curriculum at one time and one time only. When should it be? In my opinion, developed after speaking with many scientists, it should be in the third or fourth year of graduate study. First-year graduate students are busy learning many other things; ideally, ethics should be intertwined with these other things. But issues more complex and subtle than keeping laboratory notebooks—issues such as authorship, intellectual property, conflict of interest—are largely meaningless to younger graduate students. These kinds of issues, which some of them may not encounter in

their careers as students, should be discussed explicitly when the students start doing serious, original research of their own. It is a very important part of their professional development, and it is cruel—even unethical —to allow them to enter the professional world without preparing them to deal with these sometimes difficult problems.

Who should teach the responsible conduct of science?

Again, the answer is implicit in all of the above. Let me make it a bit more explicit. Scientists should teach research ethics. Chemistry students should learn research ethics from chemistry professors. Biology students should learn it from biologists.

Scientists must not leave it to outsiders—ethicists from the philosophy department, or the department of religious studies, or the Poynter Center—to teach research ethics. Having outsiders do the only teaching on research ethics sends a clear message to science students that scientists do not care about research ethics, that it is a garbage course and a waste of their time.

Please note that the above paragraph applies only when we are talking about the only course, or the required course, on research ethics. Ethicists can serve a useful function. They can teach elective courses, or they can teach units of required courses, or they can team teach with scientists. The important point here is that scientists have to be seen to be deeply concerned with these issues for the students to take them seriously.

I think it is also true that people with training in ethics will tend not to teach research ethics very well, unless they also have experience or training in science. In the past this was a rare combination, but perhaps less so today. Before the current era, discussion of research ethics was rare anywhere; today I believe there are more philosophers, sociologists, and others who have a realistic understanding than there were before 1989.

Conclusion

Although what should be taught is, to some degree, implicit in what I have already written, I want to mention one skill that students need to learn and need to discuss with teachers they can trust. What should one do, how should one act, if one encounters an instance of unethical research? Witnessing falsification or fabrication of data, or any of the other myriad violations of research ethics, puts one in a very difficult situation. Worse, our instincts about how to deal with it are often all wrong. Fortunately there are two excellent, freely available resources to help with this problem.

- Gunsalus, C.K. 1998. "How to blow the whistle and still have a career afterwards." *Science and Engineering Ethics* 4:51-64 (available at http://poynter.indiana.edu/links.shtml#SEE)

- Keith-Spiegel, Patricia, Joan Sieber, and Gerald P. Koocher. 2010. "Responding to research wrongdoing: A user-friendly guide" (available at http://www.ethicsresearch.com/)

I've outlined a fairly comprehensive program. Fortunately you are only responsible for your own small part of it.

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