



Teaching Responsible Conduct Responsibly^a

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Everyone learns at an early age to pay more attention to what people do than what they say. One of our favorite cartoons is by Edward Argo. It portrays a young child standing in the corner facing the wall and saying to his stuffed animal friend, “The same people who told me the stork brought me are making me stand here for lying.” You can substitute your own favorite example of the discrepancy between words and actions in lecture halls and the workplace. But this sums up why we believe that the “how” of instruction on the responsible conduct of research (RCR) is so much more important than the precise details of what is included in the curriculum.

What follows below is our philosophy on how training in RCR might best be provided. We then comment on some of the federal and institutional guidelines that have played an important role in promoting the introduction of RCR training into academic programs, suggesting that they are an important driving force for ethics education but also partly what led to some of its most serious—and contentious—problems.

How to teach RCR?

The most common approach for teaching most things, including RCR, is lecturing. And certainly that can be a useful method for delivering large amounts of material to sizeable groups of individuals. But, all too often, lectures quickly devolve into an exercise in dictation, providing little opportunity to engage with the material and really learn. Should this be pointed out to an instructor, the response is often “I can’t take time for discussion, there is just too much to teach!” We, too, have been guilty of this mindset, forgetting the extensive research indicating that little of the material delivered in a purely lecture format is retained.

There are many other problems with that approach, as well: The instructor may not be sufficiently knowledgeable in the subject matter or skilled in the art of teaching; the composition of the class may be highly heterogeneous

and thus not amenable to a “one size fits all” approach; and the material may be presented out of context and, thus, its significance may be difficult to grasp or may even be undermined. Lecturing is simply not an effective way to teach anything, let alone research ethics. We describe an alternative approach below. We also recommend Camille Nebeker’s essay in this issue, which provides an excellent overview of what the research on teaching and learning tells us about ways to optimize RCR instruction (9).

Who should teach?

The topic of ethics immediately brings to mind philosophers, and indeed philosophers can play a valuable role in promoting research ethics. They can help both teachers and trainees to understand ways of thinking about ethical problems. However, although you will find differing views on this topic within this issue of *JMBE*, we do not believe that philosophers are effective as the *primary* instructors of courses on this critical subject. For this, one needs people with experience in the practice of research, or at least individuals working in a partnership with active researchers. And these RCR instructors must treat their task as they would a research project: by thinking deeply about the subject matter, reading the literature, seeking advice from others, developing and testing hypotheses about what will be effective, and, finally, getting feedback on their own performance and on the impact they are having on their trainees.

Instruction that does not involve active researchers is unacceptable for at least two reasons: First, the message provided by courses that do not involve scientists is that such individuals either do not know enough about RCR to teach it, or they do not feel it is worth their time to do so. Second, non-scientists can be dangerously out of touch with the everyday reality of practitioners. For example, we have heard instructors say that all authors of any research paper must have reviewed all of the data and be able to explain all of the methods used. In theory

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this sounds entirely reasonable. But a moment's thought will make clear that such a rule is inconsistent with the complex, collaborative, and interdisciplinary nature of most of today's research.

In addition to those who direct formal courses in RCR, research group directors are another critical component of the instruction. Whatever their intention when they accepted jobs at educational and research institutions, all too often these individuals come to view the members of their teams largely as research assistants. Such individuals are likely to feel that anything that takes their lab members out of the lab is a distraction from the task at hand, and RCR training often tops the list of those "distractions." We understand this; advancement in academia is typically based on research productivity, not on mentoring. Yet, it goes without saying (though we will say it), that *irresponsible* research can never be *good* research. Research that involves cutting corners or using erroneous statistical tests, not to mention intentionally manipulating data, may be at the heart of many failures to replicate published studies that have recently been a focus of much discussion in both the professional and the lay literature (see, for example, Refs. 6 and 11). Moreover, whereas courses on RCR—when they are offered—may involve less than a dozen hours of instruction, often at the outset of a training program, research advisors influence members of their groups for thousands of hours over many years. As we have already implied, it is the example set by research directors and others in the academic environment that really counts. And it is not only the trainees that they influence, it is *all* members of their research groups.

This brings us to the overriding issue of "climate." As one would expect, a corollary of the importance of setting a good example is that the climate in which research is done has a significant impact. Some 20 years ago, Melissa Anderson, Karen Louis, and Judith Swazey set out to study this topic as part of the Acadia Institute's Project on Professional Values and Ethical Issues in the Graduate Education of Scientists and Engineers. They found that graduate students who socialized in departments in which the culture was more "caring" (e.g., one that promoted collaboration versus competition among individuals in a laboratory and was made up largely of faculty who showed an active interest in the career development of their students) reported witnessing fewer incidents of misconduct than did students in less caring environments (1). Studies conducted since then continue to echo those findings (e.g., Refs. 3 and 5).

When should instruction occur?

As we have noted, instruction in RCR is typically provided as brief, required workshops or courses taken at the very beginning of a training program. The participants in such courses are usually limited to graduate students, though sometimes postdocs are expected to attend, as well. And the impact of the course on participants is typically either not evaluated or is done so through a short essay. There is

nothing good about this approach; indeed, it is destructive. The message is obvious: "This is something we unfortunately must require you to do, so let's get it over with as quickly as we can, and then we can move on to the important things." Consider a very different model:

1. Upon arrival at an institution, all individuals—be they students, postdocs, faculty, staff, or administrators—are introduced to the importance of RCR, their own role in ensuring that it occurs, and some of the major issues. (Time: 1–2 hours.)
2. Next, all individuals involved in the research enterprise engage in a weekly seminar in which some of the key topics, usually focused on specific cases, are explored during discussions facilitated primarily by active researchers. (Time: 1 hour x 8–12 sessions.)
3. At the same time, RCR appears in the core curriculum. When an instructor discusses an issue of basic science, they might raise issues of fabrication or falsification of data, perhaps by discussing a real case in which that occurred. Likewise, when describing a clinical condition, the class might discuss an issue such as the role of informed consent or genetic counseling. (Time: 15 minutes every couple of weeks in every course, totaling 12 hours in a curriculum involving 6 courses.)
4. Finally, we move into our workspaces, be it a lab, faculty, or administrative meeting. The role of instructor now gradually shifts to the trainee, staff member, faculty member, or administrator. Ethics cases of direct relevance to the tasks at hand continue to be discussed, with the cases constructed and/or led by different members of the group. (Time: 1 hour x 2–3 sessions per year for the duration of an individual's involvement in that unit, say a total of 10 hours over 5 years.)

Now, add it up: It comes to at least 30 hours over five years. "Are you kidding?" we hear the faculty saying. "I only get two hours to teach my students about RNA editing or the Nernst equation or [fill in the blank], and you want me to spend 30 hours talking about ethics?!" But teaching about a specific topic in biology, math, or virtually any other discipline is not the right analogy. In fact, no single content area provides the right comparison, for what we must ultimately achieve through RCR education is the development of a complex skill—that of being able to reason through an ethical issue, one that often does not even have a "right" answer.

A far better exercise is to compare approaches for teaching RCR with the way in which we teach our trainees how to critically evaluate the scientific literature in their area of research. This is not accomplished in a one-hour or even an eight-hour block. We begin by introducing the trainees to some of the basic concepts of the field. Next we have them participate in "journal clubs"—in-depth small group discussions of an individual paper, simple papers at first, and then

increasingly complex ones. The papers are presented, and the discussions led, by the trainees themselves. From there we move on to discussions of papers within the research group or even in one-on-one discussions between the lab director and a specific trainee. And these trainees soon begin to write their own papers, for which they must read and evaluate the literature. Finally, in the case of graduate students, we challenge them in preliminary exams, comprehensive exams, seminars, proposal meetings, and the dissertation defense—all the time probing their understanding of the literature and their ability to justify their conclusions. As for postdocs, staff, and faculty—they get challenged, too. It happens each time they make a presentation. Yes, this process does involve learning some content—the proper organization of a paper, how to select the right statistical test, the importance of citing conflicts of interest. But mostly it involves the ability to critically analyze and then defend a position. Total time? Incalculable. Is doing research responsibly really not as important as being able to critically evaluate the literature and then defend your position?

The role of Federal and institutional guidelines

The U.S. Federal guidelines on RCR training have played a critical part in the establishment of RCR programs. Before the U.S. National Institutes of Health (NIH) issued such guidelines, it is likely that few training programs included explicit instruction in research ethics. Thus, the guidelines have had a very positive impact by promoting RCR instruction for researchers. Yet, those same guidelines also have had the unintended effect of undermining the perceived importance of RCR by turning what should be—and can be—a valuable learning experience into one viewed as an exercise simply designed to ensure that a limited population meets a bureaucratic requirement delivered in isolation from the research enterprise.

Federal guidelines. These vary by agency, though it is not clear why this should be. Why, for example, does the U.S. National Science Foundation (NSF) insist that any institution that receives NSF funding have an institution-wide program of RCR training, whereas the NIH requires RCR training only for individuals supported on training and career awards? Other agencies, likewise, have their own idiosyncrasies.

The NIH guidelines relating to RCR instruction appeared in 1989, and most training programs quickly learned that they were required to provide instruction in research ethics to at least a subset of their trainees. Since those initial guidelines, the NIH description of an acceptable RCR program has gradually evolved. Their most recent recommendations on how to fulfill their requirement for providing instruction in RCR (7) includes an excellent set of “Basic Principles” that deserve to be read carefully, as they include many of the key characteristics that we believe are critical to developing a good program.

The guidelines require that active researchers be involved in providing the instruction, and specify a minimum number of hours of face-to-face instruction. But otherwise, they are not overly prescriptive. For example, the method of instruction is left open (except that online training does not count toward the required number of hours of face-to-face instruction). Moreover, NIH does not dictate the topics that must be addressed, but instead suggests nine content areas that “have been incorporated into most acceptable plans for such instruction.” Theirs is a fine list, though vague in regard to the scope of some topics. In particular, “research misconduct” is listed but never defined within the guidelines. But its major failing is in its definition of who must receive instruction: “individuals supported by any NIH training, research, education, fellowship, or career award” (7). This, of course, overlooks many graduate students and postdocs, both because the number of such NIH-supported positions is limited and because a great many trainees are not even eligible for those positions by virtue of their citizenship. It also omits staff, faculty, and administrators involved in the research endeavor.

In their 2009 guidelines, NSF provided much less direction on the content of RCR training. They also indicated that “training plans are not required to be included in proposals submitted to NSF,” although they added “institutions are advised that they [the plans] are subject to review, upon request.” And, most relevant to us, NSF specified that the “institution must have a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to *undergraduates, graduate students, and postdoctoral researchers* who will be supported by NSF to conduct research” (italics added) (8). Unfortunately, staff, faculty, and administrators are not mentioned, nor is there any indication of the acceptability of exclusively relying on online instruction to meet their requirements.

It is clear to us that what is needed is a federal requirement—better yet, the readiness of institutions to establish programs without such a requirement—that merges these two statements and goes even further—implementing meaningful RCR training for everyone connected to the research enterprise. This was, in fact, recommended by the Commission on Research Integrity (CRI) established by then U.S. Secretary of Health and Human Services Donna Shalala in 1993 at the request of the U.S. Congress. The Commission was chaired by Kenneth Ryan and it issued its report, “Integrity and Misconduct in Research,” in 1995 (10). The 105-page document (including appendices and references) is worth reading even almost 20 years later. One recommendation deserves particular attention. Under the heading “Providing Education in the Responsible Conduct of Research” the report states:

The Commission believes that, on balance, [required education in research integrity] should be more broadly implemented to ensure that, through such training, *all individuals who perform research*

in institutional settings are sensitized to the ethical issues inherent in research. At present, the training is required only of recipients of institutional training grants, and does not reach all graduate, professional, and postdoctoral students or more senior researchers and other members of research groups, such as technicians. The Commission strongly believes that all of these individuals would benefit from participation. Providing such training is an important step toward creating a positive research environment that stresses the achievement of research integrity more than the avoidance of research misconduct. (italics added) (10)

The role of professional societies and research institutions. Soon after the release of the Ryan report, the Federation of American Societies of Experimental Biology (FASEB) held a meeting attended by representatives from a large number of scientific societies to discuss the recommendations, which one of us attended (MJZ). A major focus was the definition of misconduct and the topic of who should be trained. Our memory of the event is somewhat clouded by the passage of time but the tenor of that discussion remains clear: the group was unambiguous in their criticism of the suggestion by Dr. Ryan (who was also in attendance) and his Commission that such an “unfunded mandate” be put in place. A few years later, in a letter sent to the director of the Office of Research Integrity in 2000, Mary Hendrix, then the president of FASEB, wrote: “Students and trainees must have instruction in the responsible conduct of research ... But the extension of this requirement to ‘all staff,’ including subcontractors and consultants, will result in an enormous involvement of time and resources” (2).

The issue of “unfunded mandates” has recurred in other discussions of the Ryan report’s recommendation about RCR training. For example, in a 2009 letter to NSF, Richard Marchase, the then president of FASEB, wrote in regard to NSF’s new guidelines: “Even with access to educational materials, the implementation and administration of new training programs is not without cost. NSF should explore ways to fund these efforts so that additional training requirements do not burden institutions with new, unfunded mandates” (4). Twenty years after the Ryan Commission report was issued, the recommendation of universal training in RCR—which we whole-heartedly endorse—has not been made part of federal policy.

We recognize the many obligations shouldered by research institutions, as well as professional societies. However, we also believe that providing training in RCR to everyone involved in the research enterprise is at the very core of ensuring that all research is done responsibly, and providing that training should not require any federal mandate, funded or not. Yes, institutions are burdened with an enormous number of requirements. They must ensure the value of the degrees they award by overseeing the curriculum and the process of certification. They must assure

fiscal responsibility. They are responsible for fulfilling the requirements for human and laboratory animal research and for laboratory safety. And that is just the beginning of the list. Thus, it is not surprising that many institutions view training in RCR as yet another requirement they need to check off, and that they often do only as much as they deem necessary to fulfill the requirement. Research institutions, however, should never define themselves in terms of the minimum needed to get by. Fulfilling the mandate to provide training in RCR cannot not be viewed as an end but must be seen as a means—a means to ensure the highest level of scholarship.

A final thought: How the behavior of an individual can ripple across the scientific enterprise

There are many reasons to do everything that can be done to promote responsible research. Here we focus on one—the essential nature of trust and the cost of failing to meet that trust. The advancement of science requires trust—trust in the literature, in our collaborators, in the data we are handed, and most of all in ourselves. Each of us must know when to ignore an observation we make, when to repeat it, how to determine its significance, and when to publish. Observations in science sometimes come from individuals working on their own with little knowledge of what came before them. But observations do not become advancements until others learn about them and are able to take them seriously, at least seriously enough to try to replicate them or to examine a corollary.

How much does a story in the media about research misconduct cost? Nothing? No. It costs millions, maybe billions, of dollars. It leads individuals to stop contributing to foundations that support research. It leads voters to write their government representatives to tell them not to fund NSF or NIH. And it leads legislators to decide on their own that funding for research should be curtailed. Misconduct in science creates a breach of trust that threatens the viability of the research enterprise. It puts financial resources at risk and undermines the public’s trust in research findings. Perhaps worst of all, it can lead to students deciding that research is not for them.

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