Responsible Conduct of Scientific Research: a one-semester course for graduate students

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Hoshiko, T. Responsible Conduct of Scientific Research: a one-semester course for graduate students. Am. J. Physiol. 264 (Adv. Physiol. Educ. 9): S8–S10, 1993.—This course was developed to satisfy in part the requirement that “a program in the principles of scientific integrity” be a part of any training program funded by the National Institutes of Health (NIH) or the Alcohol, Drug Abuse, and Mental Health Administration (NIH “Guide for Grants and Contracts,” vol. 18, no. 45, 1989). The booklet On Being A Scientist (National Academy of Sciences, 1989) was chosen as required reading. The issues were presented in 15 1-h sessions. Public policy issues were not addressed. A danger was to be overly critical of scientific misconduct and stimulate a cynical skepticism of the integrity of the working scientist. One problem is that there are only general procedures a student can follow when encountering misconduct. Numerous guest speakers provided depth, objectivity, and authenticity to the discussion.

scientific misconduct; responsible science; science ethics; research ethics

THE INCREASING NUMBER of well-publicized and highly visible incidents of scientific misconduct have alarmed the federal government and the media. One response has been a call for more systematic teaching in the responsible conduct of scientific research. At Case Western Reserve University, we organized a 15-session, one-semester, one-credit course entitled Responsible Conduct of Scientific Research as a lecture-discussion offering that is open to all, but required of all beginning graduate students in our department. The booklet On Being A Scientist (10) was chosen as required reading.

The goal of this course is ultimately to instill and reinforce the student’s understanding and practice of what constitutes good science. We began with discussions on the nature of science (session 1; see Table 1), the motivations of scientists (session 2), and the ethical aspects of designing (session 8), performing (sessions 8 and 9), and interpreting (session 12) experiments. We then considered activities beyond the handling of experimental data, involving interactions with colleagues in collaborative activities such as the preparation of data for presentation and publication and the consequent issues of authorship, collegiality, and data sharing (sessions 12 and 13). Finally, we looked at professional development and the job hunt (session 14).

These topics allowed a description of traditional and current practices in science and possible reasons for their breakdown. One device that we found helpful in sketching out what and how things can go wrong was the study early in the course of a case discussed by Engler et al. (Ref. 4; session 4). This report is particularly helpful because a rather full analysis of the circumstances and validity of each of the papers published by the individual was carried out. Included is an illuminating account of the many points and circumstances that made it possible for the deceptions to have been possible in the first place and then to have gone unchallenged for so long. Peer review (session 6), conflict of interest, and whistleblowing (session 7) were examined as well. These sessions involved questions of relationships with mentors, which is a perennial source of conflict and struggle in the experience of many graduate students.

We chose a one-semester format early in the student’s training to quickly achieve a baseline of common understanding. We hoped to establish a basic level of exposure to smooth out the inevitably uneven experiences of individuals in different laboratories under different mentors. The format fosters group discussion and consensus building of permissible vs. impermissible conduct. Such activities are thought to help establish an atmosphere that encourages responsible conduct of research. In addition, the whole class exercise allowed efficient use of authorities well versed in technical and legal requirements for issues such as the care and use of experimental animals (sessions 10 and 11); radiation, biohazard, and chemical safety (session 9); responsibilities in case of misconduct and Case Western Reserve University’s procedure for handling such cases (session 7); and philosophical ethics (session 5) and the job hunt (session 14). Several faculty gave personal accounts of cases involving scientific misconduct that they had observed (sessions 2 and 5–7). Overall, the format made for efficient use of the student’s time. The structure of the course content is illustrated in Table 1, and an annotated bibliography is appended.

The wider questions of public policy in science were touched on only incidentally. Most such issues are incommensurable and were judged to be beyond the scope of this course.

The course was required for all our entering graduate students. Two students chose this course as an elective. The only requirement was attendance. I allowed up to three absences out of the total of 15 sessions to qualify for a passing grade. This turned out to be an error on my part, as is indicated below.

In general, the course was well received. The students enjoyed what each of our seven guest speakers had to say. The most popular session was a presentation by one of our staff veterinarians on animal care and use, which included a tour of the animal facility. The most criticized session involved discussion of a paper on authorship by a university president who had been forced to resign after a public uproar about indirect costs. The biggest complaint was that there was not enough time for discussion.

In a course such as this, the fact that attention is inevitably on negative aspects of research such as misconduct is unfortunate because the positive elements are
by contrast neglected. On the one hand, the visible rewards of research, such as recognition, position, and awards, tend to be denigrated as crass self-seeking, while on the other hand, the less tangible, personal, and experiential rewards of discovery and accomplishment tend to be ineffable.

A major problem faced by each student (whether she or he recognizes it or not) is the blending, into a personal ethical framework, of the three dominant themes of the course: the regulatory and legal conditions for doing research, the statistical and experimental design techniques advocated (and in some cases being mandated) for responsible research, and the clarification of the usual and customary social practices of the scientific community. This last is a continuing difficulty because there are many and changing variants in the science community. The level of personal integrity and communal generosity varies in different disciplines, and the social practices of scientists in general are changing, as noted in the face of pressures for survival. Thus the ethical issue that underlies all these themes is the question of the acceptance of a high standard of personal responsibility and conduct by each participant.

Many of these issues could be discussed more freely in informal settings and after participants had become more comfortable with sharing their own deeper feelings within the group. This unfortunately did not occur and was the major drawback of the course because it impeded development of a consensus in the group. Undoubtedly, the class sessions stimulated thought and discussion among students. The most vociferous in class discussions betrayed a tendency to be hypercritical of those involved in misconduct cases, and finally no measure of consensus was voiced. The conduct of the course was itself a manifestation of the pressures and moral trade-offs in real life: attendance at the final session on integrating their ethical perspectives was almost a complete washout because most students with the option skipped the last session. Many apparently felt they had to cram for finals in their other courses, i.e., external pressures lead to shortcuts.

Finally, the issue may be raised as to whether today's research university in its relation with the political state, each with its own agenda, can withstand the pressures of their symbiotic parasitic codependency without a crumbling of their moral and ethical principles and/or the injuring of individual scientists and potential recruits.

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ANOTATED BIBLIOGRAPHY

1. Angell, M. Publish or perish: a proposal. Ann. Int. Med. 104: 261-262, 1086. A proposal to limit the number of publications that can be considered in evaluating a candidate for promotion or funding.

2. Bernard, C. An Introduction to the Study of Experimental Medicine, translated by H. C. Green. New York: Dover, 1957. A classic recording Dr. Bernard's efforts to establish a scientific basis for medicine by a scientific study of physiological processes. Principles of scientific research are illustrated from case histories of his own work on the role of chance, error, preliminary false conclusions, and hypotheses. The application of mathematics to physiological research was pioneered by Bernard's work.


5. Grinnell, F. The Scientific Attitude (2nd ed.). New York: Guildford, 1992. An excellent account of the inner experiences and practices of individual scientists and the science community as a sociological as well as a cognitive process written in an easy-to-read manner. Current incidents of research improprieties are put within the perspective of science as an error-prone human enterprise.

6. Holton, G. The Advancement of Science, and its Burdens. New York: Cambridge Univ. Press, 1086. An analysis of how modern science works, emphasizing the role of the often unconscious pre-suppositions that guide scientific work to success or failure; Einstein's style of work, contrasted with other styles; and unforeseen consequences of the advance of modern science.


