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Socially Responsible Science Is More than "Good Science"

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The role of scientist carries an array of responsibilities. The most obvious is accurate and reliable research that can be depended upon by fellow researchers. Scientists also have a responsibility to oppose misuse or abuse in the application of research findings, and to attend to both the limitations and the foreseeable impacts of their work. In addition, as members of society, scientists have a responsibility to participate in discussions and decisions regarding the appropriate use of science in addressing societal issues and concerns, and to bring their specialized knowledge and expertise to activities and discussions that promote the education of students and fellow citizens, thereby enhancing and facilitating informed decision making and democracy.

INTRODUCTION

Since the inception of in-depth discussion of research ethics, the focus in the U.S. has been on the responsible conduct of research (RCR) (2). Emphasis is on data management, addressing allegations of research misconduct (fabrication, falsification, and plagiarism), treatment of research subjects, authorship concerns, publication practices, conflicts of interest and the like. This focus on ethical research practice has been termed "microethics."

More recently in the U.S., there has been increased attention to the larger social context of science and technology, and especially to the collective professional responsibilities of scientists and engineers to attend to the ethical implications of their work in a larger society. This socially responsible science is considered "macroethics."[a]

It is understandable that consideration of research ethics has focused on the behavior of individuals and responsible research conduct (2). However, social responsibility is the other side of the coin of the responsible conduct of research that merits further in-depth consideration and attention.

GOOD SCIENCE

Graduate students in science learn that "good science" means quality research—accurate, reliable, reproducible research that can be relied on to serve as a solid foundation upon which other researchers can build. It is an expected outcome of the responsible conduct of research (synonymous with "good scientific practice" in Europe) and, in spirit, it presumes the more detailed "good laboratory practice." Good science is a kind of covenant within the scientific community. It is what fellow researchers expect of each other as members of the global research community.

Outside the research community, scientists are generally assumed to be competent and honest, but integrity is not enough. For much of society, "good science" means science that does good, that benefits society and, in some quarters, that benefits the planet. Often, those who understand "good science" in this way are unaware of the meaning the term has within the scientific community and it can be a source of misunderstanding and miscommunication.

SOCIALLY RESPONSIBLE SCIENCE

It is the latter, larger notion of good science that informs thinking about the social responsibility of scientists. At its foundation is the idea of professional responsibility and what members of society at large, outside of a given profession, expect, rightly or wrongly, of members of that profession. Analogous to the Paramountcy Provision of the Engineering Code of Ethics, that "Engineers, in the fulfillment of their professional duties, shall hold paramount the safety, health and welfare of the public" (11), the Uppsala Code of Ethics for Scientists emphasizes the expectation that scientists will pay attention to the health, safety, and welfare of the public and the environment (6). The Uppsala Code highlights the responsibility of scientists to refrain from, and also speak

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[a] John Ladd (9) introduced this terminology, which has been expanded and enhanced by Joseph Herkert (7). It should be noted that macroethics includes decisions made by society about science and technology as well as the efforts of science and technology professionals. It should also be noted that, while consideration of social responsibility and the larger societal context of science and technology are relatively new additions to the ethics education of scientists and engineers, programs and courses in science, technology, and society (STS) have been available for decades at many universities, even though they usually have not been required for students majoring in science and engineering.

out against, weapons research and other scientific research with the potential for detrimental consequences for present and future generations and for the environment. Definitions of the social responsibility of scientists and engineers may even include a proactive "duty to safeguard or promote a peaceful, just and sustainable world society" (16).

The social responsibility of scientists flows from the fact that scientists are members of society as a whole, as well as members of the scientific community. They have a dynamic relationship with society that brings responsibilities. Their capabilities, education, skills, training, and expertise equip them to bring specialized knowledge and perspectives to the understanding and analysis of issues and problems that afflict the society of which they are a part. The social responsibilities of researchers arise not simply because research is funded (directly or indirectly) by the public. More to the point, these responsibilities derive from the fact that research is carried out in the name of society, as an expression and a reflection of the society's needs, interests, and priorities, and of the expected or presumed consequences of the research findings.

The social responsibilities of researchers include, but also extend beyond, upholding the ethical standards of society while carrying out research (e.g., the humane treatment of research subjects, whether humans or laboratory animals). It is generally the case that basic scientists have little control, if any, over the use or misuse of their research. As a result, a widely held view within and beyond the research community is that the user rather than the scientist is responsible for how research findings are used (8): it is the military and the politicians, not Robert Oppenheimer and his fellow scientists, who should be held responsible for the death and destruction caused by the atomic bomb. Yet all research is not the same. It is one thing to investigate the secrets of the atom which may lead to unimaginable applications; it is another to work to apply those findings to develop a bomb with only one obvious use and environmental impacts (as well as health, safety, and public welfare effects) that are uncertain though predictably large. The nature of the connection between research and its product is an important element in considering the responsibilities of scientists.

Furthermore, the special knowledge that comes from a scientist's work, education, or training enables him or her to understand the limits of the science, and when its application (e.g., in the development or support of public policy) is a misuse or even abuse of the science. Researchers have a responsibility not only to oppose the misuse of their work, but further, to attend to its foreseeable societal impacts.

SOCIAL RESPONSIBILITY WITHIN THE SYSTEM AND IN SOCIETY

In the U.S., the expectation that scientists will provide more than quality research alone underlies some requirements of funding. The National Science Foundation (NSF) has implemented a "broader impacts" criterion (BIC) for the merit evaluation and funding of grant proposals[b], and the National Institutes of Health (NIH) now includes "significance" as a criterion for evaluating project proposals. Further, the various formulations of the America COMPETES Act (1) imply an expectation that research should benefit society, as does the 1993 U.S. Government Performance and Results Act (GPRA) (12). While the BIC and "significance" are meant to encourage and promote social responsibility, they leave much room for interpretation. Some scientists respond to the NSF's BIC by developing plans to recruit under-represented groups into their research groups as fellow researchers, or by proposing plans for public outreach and education about the science (often through science museums). A more farsighted approach would involve explicitly identifying and addressing the ethical, legal, and social policy issues raised by the research and its limits. Similarly, in considering the potential significance of their work, NIH applicants seeking funding for their research tend to focus on bench-to-bedside translational possibilities (that is, the potential role of research findings in developing therapies for medical conditions), without noting limitations, long-range drawbacks, or unlikely but potential, negative consequences of the application of the work.

While the standard responses to requests for researchers to consider the wider social issues related to their work are positive steps, they are somewhat removed from the view that researchers should be prepared "to gather and interpret relevant data (… within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues" as well as "to integrate knowledge … and formulate judgments … that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments" (4). The scientific community can do better: scientists can be far more proactive in recognizing and responding to their broader social responsibilities both within the scientific community and in the larger society.

Oversight

Scientists serve in a number of capacities where they provide a kind of oversight among their peers. As members of institutional and departmental committees that consider recruitment, hiring, promotion, and tenure, faculty have the responsibility of assuring that all members of their departments and institutions are not only good researchers, but also effective educators and helpful mentors to students and trainees (5). In organizations and professional societies, on grant review committees for funders, and as peer reviewers for journal articles, scientists can comment on research

[b] The NSF proposal instructions and proposal review form ask that the proposal specifically describe and be evaluated on "the broader impacts of the proposed activity" (http://www.nsf.gov/pubs/2002/nsf022/bicexamples.pdf).

in terms of both scientific and social merit. For example, adequate attention to the sex of research animals in basic research has implications for the extent to which findings are generalizeable to clinical studies. Similarly, gender and ethnicity in clinical research can have significance for the applicability of research findings to therapy. In addition, as researchers organize professional and public symposia to discuss research findings, they can choose to include consideration of the societal impacts of that research.

Furthermore, keeping in mind the NSF's BIC and the NIH "significance" criterion, grant proposal reviewers can nudge fellow researchers to be more proactive in considering the broader impacts of their work, even though it seems unlikely that a relatively anemic response to the NSF or NIH requirements would be evaluated by an NSF or NIH study section composed of fellow researchers as so insufficient that it would torpedo a scientifically "elegant," "imaginative," or simply "sound" proposal.

Direction of research

As grant proposal and manuscript reviewers, scientists are also well positioned to participate in determining the direction of research. Daniel Sarewitz has observed that, for society as a whole, the pertinent questions are "What types of scientific knowledge should society choose to pursue? How should such choices be made and by whom? How should society apply this knowledge, once gained? How can 'progress' in science and technology be defined and measured in the context of broader social and political goals?" (13).

Scientists are often rightly perceived as largely indiscriminate advocates for science funding over other possible public expenditures. Yet, when mindful of the limitations, uncertainties, risks, and hazards of the science, scientists have the capacity to reflect on what kinds of science meet the needs of the society and how best to apply new technologies and research findings. For example, researchers can be, and have been, actively involved in discussions of potential dual-use technologies at the cutting edge of health science and biomedical science research that have the potential for putting public health, safety, and welfare at risk. Additionally, technologies in general, and information and communications technologies (ICT) in particular, in addition to their potential environmental impacts, can exacerbate wealth disparities and have unintended social, psychological, economic, and cultural consequences. These are equally damaging and more subtle than the obvious negative impacts on public safety, health, and welfare that are more commonly noted as potential outcomes of technological development (14, 15).

The involvement of scientists and engineers in decisions regarding technology can provide an uncommon perspective and voice in societal discussions as members of one of a number of "publics" that make up a global as well as a domestic society. In combination with other groups and individuals who bring other types of expertise, researchers can promote and engage in identifying problems and issues that would benefit from the efforts of scientific research. Such discussions should recognize, acknowledge, and address the range of interests, values, perspectives, and needs of all members of the society. As participants in these discussions, scientists can help to build multidisciplinary and cross-disciplinary bridges aimed at focusing on the social accountability of publicly funded research, as is exemplified by a number of national and international efforts (e.g., Arizona State University's Center for Nanotechnology in Society; funding of research into the ethical, legal, and social implications [ELSI] of the human genome project; the Dutch Rathenau Institute; the Danish Board of Technology).

Education

Researchers can also contribute to conversations and decisions in a wider society that is often unable to foresee the long-term implications and consequences of the science (e.g., restriction enzymes in molecular genetics made possible genetic engineering, genetic diagnosis, and predictive genetic testing). In particular, scientists can bring their expertise to the full range of discussions from informal conversations with family, friends, and neighbors to participation in school board and town meetings, and from classroom discussions, radio call-in shows, newspaper OpEd pieces, and community presentations to congressional testimony.

In addition, and perhaps more importantly, scientists can address the widespread misapprehension of science. Science is widely perceived and represented as objective truth, without acknowledgment or even recognition of the values and assumptions embedded in the research process, in the questions that are asked and investigated, in research design, and in data analysis, interpretation, and presentation (10). The representation of science as a search for the truth can stifle discussion of competing values and interests that should be identified and explored in a democracy. This is a topic that needs to be explicitly examined in precollege science and math courses, and college-level science, engineering, and mathematics. It is also an issue that merits active consideration in public lectures and policy discussions.

Democracy and public policy

In discussing the role of science in society, the emphasis should rightly be less on advocacy for science funding and more on enabling democracy and informed decision making in a complex and uncertain world. It is worthwhile to consider the ways that science literacy enables a democracy by promoting and facilitating an informed electorate. As Adam Briggle points out:

> Discussion of the ethical implications of the use of scientific research is, at its core, about procedures for democratic decisions and the allocation of authority and voice among competing societal groups.

> This can be construed in broad terms ranging from criticisms of Western science as a dominant, even hegemonic, way of knowing that drowns out other voices, to defenses of science as an inherently democratizing force where truth speaks to power. These vague issues take on importance in concrete contexts that concern judgments about the appropriate degree of scientific freedom and autonomy within democratic societies. The most important area in which these issues arise is the use of scientific knowledge in formulating public policies. (3)

Scientists can help both society and the research community negotiate the tightrope between self-deception and ignorance: the challenge to society as a whole, and policy makers in particular, is to assess and balance scientific merit, technical merit, and social merit, short-term risks, long-term risks, and rare but serious negative impacts. Scientists know to be skeptical of themselves and their colleagues because they understand the potential for unconscious bias and self-deception.

CONCLUSION

Scientists have much to contribute to society, and a right and responsibility to do so. Doing good quality work is where our responsibilities begin, not where they end. Scientists, as individual members of society and as citizens, can bring specialized knowledge that may be essential to addressing social concerns (although not sufficient). It is a valuable perspective that, when provided alongside other valuable perspectives, offers the potential for effective application of scientific education and expertise to societal and global concerns.

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