

RESPONSIBLE ADVOCACY IN SCIENCE: STANDARDS, BENEFITS, AND RISKS*

Nicholas H. Steneck, PhD
University of Michigan

In principle, when science is undertaken properly and professionally, the findings should speak for themselves. Scientists use professionally recognized methods to gather and interpret information. Their work is reviewed by professional colleagues (peers) and subject to verification and replication. It is this process, not the individuals who undertake science, that gives weight to its findings. If you want to know what science says about a particular problem or issue, check the findings, don't ask the scientist.

Society does, of course, routinely ask scientists about their own findings and the findings of colleagues. Journals, such as *Science* and *Nature*, usually seek the views of peers when reporting new findings. Governments turn to scientists for advice when they are grappling with difficult issues. Prize-winning scientists carry particular weight and are relied upon for advice on topics that extend far beyond the expertise that led to their recognition. Scientists play a crucial role when it comes to communicating and interpreting science.

This paper looks at the special role scientists play when their communications move beyond reporting and explaining to advocating. I will focus primarily on advocacy as a professional activity undertaken by individual scientists. I will also focus on advocacy as an aspect of external, public communication. Admittedly, this is not the only context in which scientists advocate. Grant proposals and letters of recommendation are forms of advocacy—the former for one's own research and the latter for students and colleagues with whom one has worked. How scientists should behave in these internal, professional settings is important but also addressed in the rules and guidelines for grant applications, peer review, publication and other inter-professional activities. Similar rules and guidelines are not as readily available for scientists when they communicate with non-professionals, and particularly when they engage in advocacy. This paper presents a

* Written for the AAAS Workshop on Advocacy in Science. May not be quoted or duplicated without permission of the author.

framework for discussing how such rules and guidelines could be developed and a suggested “Code of Conduct for Advocacy in Science.”

The first section of this paper provides a brief overview of scientists’ responsibilities when communicating with the public. The second section then looks at the unique features of advocacy and how its uniqueness impacts the general principles for public communication. Sections three and four explore some of the unique challenges faced when scientists advocate for science and for greater public goods, as a way of identifying the benefits and risks of advocacy in science. This leads in the final section to suggestions for how a code of conduct for advocacy by scientists could be developed and what such a code might look like.

1. Scientists' responsibilities in public communication

Responsibility in science begins with the general principles for behavior that apply to all professional activity and are enumerated in professional codes of conduct. While there is no singled agreed-to set of general principles for all of science, there are some many obvious points of agreement. This paper uses the global principles for responsible research set out in the 2010 *Singapore Statement on Research Integrity* as a framework for further discussion. (1) According to these principles, scientists should display:

- Honesty in all aspects of research
- Accountability in the conduct of research
- Professional courtesy and fairness in working with others
- Good stewardship of research on behalf of others

To this can be added the first and paramount responsibility set out in the *Singapore Statement*, integrity: scientists “should take responsibility for the trustworthiness of their research.” All other responsibilities are essentially amplifications of these basic principles and the first, fundamental responsibility to overall integrity in all aspects of science.

Due to the different professional contexts in which scientists work, different codes and guidelines for science stress different responsibilities when communicating with the public. Some of the more important ones include:

1. *Limit communication to area of expertise.* Scientists are specialists. They do not know all things about all fields of science. They have special expertise and are valued for that expertise. When they speak as scientists, they should limit their remarks to their area(s) of expertise and clearly separate personal from professional opinion.

2. *Present information accurately, in clear, understandable terms.* Clarity and accuracy are always important in scientific communication, but especially when communicating with the public. Information should be communicated in ways that can be easily understood and not misunderstood or misinterpreted. This often takes skills that a scientist may not have. A scientist who does not have that skill either should seek to gain it or consider not engaging in public communication.

3. *Disclose relevant interests.* Scientists are presumably driven primarily by the search for reliable scientific knowledge and understanding, but they can be and often are influenced by other factors. Financial interests are usually felt to have the most significant distorting influence on science, but they are certainly not the only interests that influence scientists. Since financial and other interests are not always obvious, particularly to the public, when they engage in public communication scientists should disclose interests that might reasonably be expected to influence them.

4. *Point out weaknesses and limitations.* One of the great strengths of science as a way of gaining knowledge and understanding is its commitment to constant questioning and rethinking. It is widely expected within science that reports of new findings should be accompanied by discussions of weaknesses and limitations. This expectation is equally applicable to public communication, and one that poses great risks if it is not followed. Lack of candor about weaknesses can raise doubts about the reliability of everything a scientist says.

5. *Mention opposing scientific views.* The need for candor extends as well to presenting different and potentially opposing scientific points of view, but with some

obvious limitations. The public might well question the credibility of a back surgeon who gave a public lecture on ways to lessen back pain without any mention of physical therapy. The same expectation might not extend to an evolutionary biologist talking about the relationship between dinosaurs and birds. There is genuine scientific disagreement over the effectiveness of surgery vs. physical therapy for particular back conditions. There is little or no disagreement among evolutionary biologists about the merits of evolution vs. intelligent design. Serious differences of opinion within science should be reported. The same obligation does not necessarily extend to non-scientific critiques of science.¹

Putting these elements together, the initial framework for guiding and judging responsible public communication in science, including advocacy, looks some like the following:

Code of Conduct for Science

1. Be honest, accountable, fair and a good steward
2. Accept responsibility for the trustworthiness of science

Guidelines for public communication

1. Limit communication to area(s) of expertise
2. Present information accurately and in clear, understandable terms
3. Disclose interests
4. Point out weaknesses and limitations
5. Mention opposing scientific views

2. Advocacy as a unique form of public communication

¹ It is understood that there is often disagreement over “scientific” versus “non-scientific” views or critiques. Supporters feel that intelligent design is science-based, opponents feel that it is not. Scientists need guidance on how to address these differences in perspective when engaged in public discussions. This author’s view is that differences in perspective should be mentioned but not necessarily engaged in detail since there is usually no common ground for reaching agreement.

Advocacy is a special form of public communication. The ideal scientist should be concerned primarily with the discovery of and reporting of the truth. An advocate cares about outcomes and seeks to urge others to take particular courses of action or to reach particular conclusions. Scientists become advocates when they move beyond reporting, clarifying, interpreting and explaining to advising and recommending.

The distinction between dispassionate science and passionate or partisan advocacy is captured in the 1989 AAAS policy on lobbying. The policy defines lobbying as “any attempt to influence any legislation through any attempt to affect the opinions of the general public.” It also notes that “[a]dvocacy on either side of a specific legislative action or proposal is defined as lobbying.” (2) Putting these two statements together, advocacy can be thought of as *attempts to affect the opinions of the general public or some identifiable subpopulation*.

When scientists become advocates, they become “partisans” and are no longer neutral conveyors of scientific information. While the line between neutral and partisan, between dispassionate and passionate, is not easily drawn, it nonetheless exists, as further described in the AAAS policy on lobbying:

... activities related to the preparation and distribution of nonpartisan analysis, study or research are not lobbying activities. Such work may even advocate a particular position but it must also contain a sufficiently full and fair treatment of the pertinent facts to enable the formation of an independent opinion. (2)

In other words, when communicating as scientists, scientists have a responsibility to provide balanced, understandable information to enable others to make informed decisions. When communicating as advocates, scientists may not have this obligation and can presumably make their case in the most effective way.

This difference in perspective, as nonpartisan conveyor of information versus partisan advocate, presents a dilemma for the responsible scientist and the framework outlined above for responsible public communication. The dilemma arises from the fact that the goals and methods of advocacy can conflict with the goals and methods of science. In

situations where they do conflict, which goals and methods should scientist *qua* advocates adopt? When advocating, should scientists limit their activities to their area of expertise and present their ideas clearly and understandably? Should scientists be obligated to declare their interests, discuss weakness and limitations, and present opposing views, particularly if this might undermine the positions for which they are advocating? Is it really necessary when advocating for more public support for science to point out the competing needs of the military or the poor? Advocates have a responsibility to make the best case they can, not to make everyone else's case. If presenting only the evidence that agrees with a position or remaining silent about competing interests best does this, isn't this acceptable? From the advocate's perspective, the answer would seem to be it is acceptable. From the scientist's perspective, it is not, creating the dilemma that scientists face when they become advocates.

In sum, the views of scientists are respected because they are scientists and represent everything that science stands for, including the dispassionate presentation of the facts. When they act as advocates, they are likely to be in conflict with the professional norms of science, allowing them to ignore or violate some of the rules for responsible science. The main challenge from the standpoint of developing guidance for advocacy in science is how to responsibly merge these two perspectives. Are there elements and conditions that could be added to the guidelines for public communication outlined above that would help scientists make responsible decisions when they advocate? Or are advocacy and science so much at odds that scientists cannot be both scientist and advocate? The final sections of this paper explore these questions by looking at some specific cases, with the goal of identifying the benefits and risks of advocacy in science.

3. Risks and benefits of scientists advocating for science

The most common form of advocacy in science is probably advocating for science. Scientists lobby for funding, improved science education, scientific freedom, self-regulation, and for many other policy options that support the well being of science.² To the

² This is one area of advocacy (lobbying) in which non-profit organizations such as AAAS can cautiously engage without threatening their non-profit status. "In activities related to "self-

extent that society benefits from science, advocating for science is beneficial to society as a whole. If science is strong, society will benefit. However, this is also the area of advocacy in science that raises obvious concerns since there are clear conflicts of interest. When scientists advocate for more support for science, are they doing so in the best interest of society or in their own self-interest? And does self-interest have any impact on the reliability of the advice given to the public? The following cases illustrate some of the risks that arise when scientists advocate for science.

Case 1. Expertise. Scientists generally seem comfortable providing advice based on two grounds: 1) as trained experts in particular fields of study and 2) as individuals who are familiar with and experienced in the ways of science. The first can be thought of as *formal expertise*, the latter as informal or *experienced-based expertise*. It is the latter, experienced-based expertise that causes problems when scientists become advocates, as illustrated by the advice scientists provided for dealing with misconduct in science.

When misconduct in science first became a problem for public discussion in the early 1980s, government turned to the science community for advice. A number of prominent scientists eagerly provided advice, based largely on their experienced-based, not formal, expertise. At the time, there were few experts on research behavior and little if any empirical information on which to base decisions. However, this did not stop scientists from providing advice and advocating for specific policy decisions, based on the experience-based but undocumented belief that scientific misconduct is “rare” and kept in check by self-regulation. (3)

Subsequent studies of the behavior of scientists have shown that much of the initial advice the presumed science experts provided was not accurate and led to the adoption of policies that have failed to produce a comprehensive approach to protecting the integrity of publicly funded research. Thirty years into the discussion, government agencies are still

defense” of an organization, a wide range of leeway in legislative actions is permitted. Self-defense items include matters which threaten or affect the existence of AAAS, its powers and duties or its tax-exempt status.” (2)

struggling to define and protect integrity in science, as evidenced by the different ways the Federal Agencies are responding to the 2009 Presidential Memorandum on Scientific Integrity. (4, 5) The significant differences in the new integrity policies under development strongly suggests that the scientific community has still not developed a clear understanding of the most important problems in scientific integrity much less ways to address them.

This case points to one of the primary risks associated with advocacy in science. Science carries weight in public discussions. When a scientist advocates for a particular position, the argument carries weight because the person is a scientist. But not everything scientists say or advocate has the backing of science behind it. This might be obvious in the well-known example of Linus Pauling arguing for the benefits of Vitamin C, or the application of Einstein's various pronouncements to the problems of daily life. It was not obvious when Congress first thought about how to respond to misconduct (called "fraud" at the time) in science. It seemed reasonable to assume that scientists knew what they were talking about since they were scientists. But in this and other situations, scientists often advise and advocate well beyond their expertise. This problem needs to be addressed in any guidelines developed for advocacy in science.

Case 2. Bias and incomplete communication. The importance of clear, understandable communication for advocacy as well as for science might seem obvious. If you want someone to make a particular decision, you should urge that position in the clearest possible terms. But this is not always the case when scientists engage in advocacy. Scientists are usually very clear about the benefits of projects, but not as forthcoming about costs and likely timeframe for paybacks/benefits. In retrospect, it is now questioned whether those who advocated for a war on cancer in the early 1970s, or for the human genome project in the early 1990s, were as clear and open as they could/should have been about future paybacks. (6-8)

The need to convey clear understanding when advocating for science is particularly important for clinical trials. The ethics of all human-subject research rests fundamentally

on “informed consent.” Scientists must make sure subjects understand what they are agreeing to. Much has been written about this in the context of individual consent, but much less in the context of scientists advocating more generally for support for clinical research.

The design of most clinical trials is based on the hypothesis that scientists do not know whether the trial intervention is more effective than standard treatment—the principle of equipoise. On average, anyone enrolling in a trial stands as much chance of being harmed by the intervention as helped. The ethical justification for conducting trials in this way is that it would be unethical to put subjects into a control group if it were known that the intervention were better. Some, but not all, clinical research trials can only be conducted if the outcome is uncertain (50/50).

The importance of uncertainty in clinical trials is sometimes not mentioned or passed over quickly in the materials scientists use to promote clinical research. For example, the main source of trial information in the US, ClinicalTrial.gov, mentions that “the experimental treatment may not be effective for the participant,” but gives no further detail. (9) The variation in which further information is provided can be illustrated by two examples. The Harvard Medical School’s main trial recruiting page attempts to lower expectations by pointing out that:

Many people start a clinical trial with unrealistic expectations. For example, they believe (or will themselves into believing) that experimental therapy will work for them — although the premise of any trial is uncertainty about exactly that. (10)

The Roswell Park Cancer Institute conveys a much more optimistic tone, when responding to the “myth” that the subject might receive a placebo as follows:

Few cancer clinical trials use placebos, and they are never given to cancer patients in place of treatment. Cancer patients who take part in clinical trials must receive at least the best standard treatment available. In many cases, they will receive a new and better therapy being evaluated. (11)

Given that studies have shown that cancer researchers are not good at predicting the effectiveness of new interventions(12), it could be argued that the second description of clinical trials does not provide a clear understanding of how trials operate.

Science is not easy to understand. Explaining the complexities of science can be a challenge. However, when advocating for science, if scientists fail to provide the knowledge society needs to make informed decisions about science or fail to understand the limits of their own expertise, advocacy for science by scientists can pose significant risks both to society and to science itself. To avoid these risks, the general rules for public communication outlined above need to be expanded to cover specific areas where advocacy by scientists can go wrong. However, before suggesting modifications, it is important to look at the other major goal of advocacy in science, to influence public decision-making in general, not merely decisions limited specifically to science.

4. Risks and benefits of scientists advocating for society

The previous cases focused on scientists advocating for positions that reflect at least in part their own interests, e.g., self-regulation of research misconduct and increasing participation in clinical trials. Scientists also advocate for positions that serve greater public goods, as illustrated by the long-standing activities of the Union of Concerned Scientists. (13) UCS characterizes itself as:

... the leading science-based nonprofit working for a healthy environment and a safer world. UCS combines independent scientific research and citizen action to develop innovative, practical solutions and to secure responsible changes in government policy, corporate practices, and consumer choices. (14)

Its efforts are currently focused on policies relating to scientific integrity, global warming, clean vehicles, clean energy, nuclear power, global security, and food and agriculture. It's approach is based on "rigorous scientific analysis, innovative policy development, and effective citizen advocacy." (Ibid.)

Case 3: Science advocacy groups. UCS does not explain how it mixes "rigorous scientific analysis" and "citizen advocacy." Based on its various advocacy efforts, the main

practice seems to be to combine the rigorous scientific analyses of key problems with grass-roots, or what might be thought of as citizen-based, efforts to draw attention to these problems. For example, to draw attention to its long-standing effort to reduce or eliminate nuclear weapons, just before the 2008 Democratic and Republican national conventions, it posted signs in the Minneapolis (and Denver) airports reading: “When only one nuclear bomb could destroy a city like Minneapolis ... Why do we need 6,000? Senator McCain, it’s time to get serious about reducing the nuclear threat” (read Denver and Obama for the Democratic convention). (15) The signs were later removed, allegedly in response to objections by Northwest Airlines, but rigorously defended by USC as both appropriate, and not objected to by many of the major players. (16) This and similar activities over the years have led to accusations that UCS is politically biased (left-wing), which, in turn, raises the issue of the politicization of science.

Scientists are citizens as well as scientists. They have the same rights as other citizens to advocate for any position they want. However, when they advocate as citizens and do not make a distinction between their activities as citizens versus their activities as scientists, they run the risk of politicizing science. And this, in turn, brings us back to the dilemma raised previously. If science should ideally be value-free, then anything that brings values into science should be resisted, leading to the conclusion that scientists should not advocate as scientists. If they feel strongly about issues, as citizens they can advocate, drawing on their expertise as scientists, but they should advocate as citizens and not scientists. If, on the other hand, it is felt that science can never be value-free and is inextricably linked to society’s values as a whole, then it could be concluded that scientists not only can, but have a moral responsibility to advocate. To do anything less would be to deny the main reason society supports science. Not surprisingly, it is this stark contrast in views that makes it so difficult to write codes of conduct for science, including codes for advocacy in science. (17, 18)

5. A code of conduct for advocacy in science

As a way around this dilemma and with the goal of developing guidelines (a code of conduct) for science, it may be helpful to return to basics. Scientists generally accept the

basic principles of honesty, accountability, fairness and a good stewardship, regardless of the setting or goal of scientific activity. There is also broad agreement on the importance of integrity—accepting responsibility for the trustworthiness of one’s activities— and the responsibility for reporting interests, limitations and competing views. In other words, the basic guidelines for public communication outlined above seem generally applicable to advocacy and can be used as a foundation for a code of conduct for advocacy in science.

The importance of these general principles is evident in a set of “tips for science advocacy” published *Nature* (right) (19). The tips assume that scientists should be clear, concise, and not “afraid to state the limits of [their] knowledge.” They also present additional warnings about political and career consequences scientists would be well advised to take into consideration when they advocate. These warnings can be used to provide additional normative guidance as part of a proposed code of conduct.

TIPS FOR SCIENCE ADVOCACY

- Know your audience. Communicate your science in a clear, concise but intelligent manner.
- Consider other implications aside from just the budgetary — how should the science initiatives be prioritized?
- Recognize the perceptions of different fields and disciplines — for example, some US congressmen have a negative view of scientists associated with environmental groups.
- Be aware that explicit advocacy activities, especially if allied with a certain political party, could cause some tension with colleagues who disagree.
- Be careful when reaching outside of your area of expertise. Don’t be afraid to state the limits of your knowledge on a subject.
- Consider advocating through a science society that knows the issues.
- Recognize that a full-time career move to advocacy could affect your prospects for returning to research.
- Recognize that other factors, such as values, jobs and economics, play into science policy. Laws rarely grow out of scientific evidence alone.

The issue of whether scientists should or should not engage in advocacy has been ongoing for decades as part of the larger discussion of social responsibility. The *Singapore Statement on Research Integrity* takes a neutral position on this issue, suggesting that “Researchers and research institutions should recognize that they have an ethical obligation to weigh societal benefits against risks inherent in their work.” (1) The *Statement* does not say whether they have an ethical responsibility to act on this obligation, nor whether they should engage in advocacy. However, other efforts to clarify the responsibilities scientists have in relation to society are more assertive.

For example, the International Council for Science (ICSU) report on *Freedom, Responsibility and Universality of Science* includes a comprehensive list of responsibilities to society, all of which could imply a responsibility to get engaged in advocacy, such as the community responsibility “to support good, evidence based, policy-making. (20, 21) (right) The report also strongly suggests that scientists should follow good scientific practice, as outlined in the above guidelines for responsible public communication, such as acknowledging “scientific risk and uncertainty” or “communicating responsibly and honestly.” In other words, scientists have a responsibility to engage social issues, but in doing so they should follow good scientific practice.

Community responsibilities to society

- Responsibility to contribute to the wealth of shared human knowledge and experience
- Responsibility to generate, and promote the use of, relevant science to improve human welfare and sustainable development
- Responsibility to try to ensure the benefits and minimize the potential dangers of applications of science
- Responsibility to support good, evidence based, policy-making
- Responsibility to promote public engagement in science
- Concern for the greater common good

Individual responsibilities to society

- Upholding the Principle of Universality and its inherent values of openness, equity and non-discrimination
- Respect for human rights, animals and the environment
- Acknowledging scientific risk and uncertainty
- Being accountable in any advisory capacity
- Communicating responsibly and honestly
- Placing societal benefits before the pursuit of personal profit

The authors of the ICSU report clearly understand that the principles for good science and effective advocacy can conflict. When this happens, they appear to conclude that scientists should be guided first by responsible practice for science, while understanding that the distinction between science and advocacy is not always clear:

There can be a fine line between providing scientific evidence for policy formulation and lobbying for a particular course of action; the freedoms and responsibilities of scientists on both sides of the climate change debate are not always clear-cut. How can scientists communicate most effectively with the media and decision-makers, whilst being transparent about the degrees of scientific consensus and scientific uncertainty? Are there any situations where individual academic freedom should be tempered in the interests of scientific consensus or political imperatives? (20)

Although posed as questions, the proposed balance for responsible advocacy would seem to be on the side of “being transparent” and tempering “individual academic freedom” to the collective view of the scientific community in public discussions. Overall, I agree with this position, and have incorporated it into the following proposed Code of Conduct for Advocacy in Science, which benefitted from discussions during the AAAS Workshop.

Code of Conduct for Advocacy in Science

As a scientist:

- Be honest, accountable, fair and a good steward in all of your professional work
- Accept responsibly for the trustworthiness of your science

When acting primarily as a scientist reporting, explaining and interpreting your work:

- Present information clearly, in understandable terms; avoid making exaggerated or unsubstantiated claims
- Be aware of and make your interests transparent when presenting views on particular decisions
- Point out the weaknesses and limitations of your arguments, including data that conflict with your recommendations
- Present opposing scientific views; recognize critiques by others
- Recognize when your activities as a scientist merge into advocacy

When providing advice to others on policies and courses of action (advocating):

- Base your advocacy on your area(s) of expertise, separating formal expertise from experience-based expertise and personal opinions
- Make clear when you are speaking as an individual scientist as opposed to someone formally representing a scientific organization and/or a group of scientists
- Be aware of the impact your actions as an advocate can have on science and its uses
- Take steps to become knowledgeable about the complex issues that have a bearing on public decisions

References

1. World Conferences on Research Integrity. *Singapore Statement on Research Integrity*. World Conferences on Research Integrity; 2010: <http://www.singporestatement.org/>.
2. American Association for the Advancement of Science. *AAAS Policy, Guidelines, and Procedures for Communications with Congress*. 1989: http://archives.aaas.org/docs/documents.php?doc_id=412.
3. Steneck NH. Confronting misconduct in science in the 1980s and 1990s: What has and has not been accomplished? *Science and Engineering Ethics*. 1999 Apr 5(2):161-76.
4. Office of Science and Technology Policy. *Memorandum for the Heads of Executive Departments and Agencies: Subject: Research Integrity*. 2009: <http://www.whitehouse.gov/the-press-office/memorandum-heads-executive-departments-and-agencies-3-9-09>.
5. Office of Science and Technology Policy. *Scientific Integrity Policies Submitted to OSTP*. 2011: <http://www.whitehouse.gov/blog/2011/08/11/scientific-integrity-policies-submitted-ostp>.
6. Allen S. Critics blast slow progress on cancer. *The Boston Globe*. 2007, 2 December.
7. Daiger SP. Genetics. Was the Human Genome Project worth the effort? *Science*. 2005 Apr 15, 308(5720):362-4.
8. Wade N. A dissenting voice as the genome is sifted to fight disease. *The New York Times*. 2008, 15 September.
9. National Institutes of Health. ClinicalTrials.gov.: <http://clinicaltrials.gov/ct2/info/understand#Q06>.
10. Harvard. Should you enroll in a clinical trial? ; 2011: http://www.health.harvard.edu/newsweek/Should_you_enroll_in_a_clinical_trial.htm.
11. Roswell Park. Demystifying common clinical trial myths. 2011: <http://www.nccn.com/component/content/article/76/225.html>.
12. Djulbegovic B, Kumar A, Soares HP, Hozo I, Bepler G, Clarke M, et al. Treatment success in cancer: new cancer treatment successes identified in phase 3 randomized controlled trials conducted by the National Cancer Institute-sponsored cooperative oncology groups, 1955 to 2006. *Archives of Internal Medicine*. 2008 Mar 24, 168(6):632-42.
13. Charles D. From protest to power: An advocacy group turns 40. *Science*. 2009, 323(6 March):1279.
14. Union of Concerned Scientists. About Us: <http://www.ucsusa.org/about/>.
15. Rohter L. No nukes? It's no billboards. *The New York Times*. 2008, 21 August.
16. Union of Concerned Scientists. UCS ad removed from Denver airport, too. 2008: http://www.ucsusa.org/news/press_release/ucs-ad-removed-from-denver-0144.html.
17. Steneck NH. Fostering professionalism and integrity in research. *University of St Thomas Law Journal*. 2008, 5(2):522-41.
18. Energy Institute at the University of Texas at Austin. 'Universal Standards' for research integrity may have unintended consequences. 2011: http://energy.utexas.edu/index.php?option=com_content&view=article&id=101:universal-standards-for-research-integrity-may-have-unintended-consequences&catid=34:press-releases&Itemid=54.
19. Russo G. Political will. Scientists who enter the world of political advocacy stand to gain perspective but could face a culture shock. *Nature*. 2008, 453(31 July):662-3.
20. International Council for Science. *Freedom, Responsibility and Universality of Science*. ICSU; 2008.
21. Irwin A. Scientists accept need to act responsibly. *Science and Development Network*. 2011, 30 September.