LETTERS

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 6 months or issues of general interest. They can be submitted through the Web (www.submit2science.org) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

Using Ethics to Fight Bioterrorism

M. A. SOMERVILLE AND R. M. ATLAS ARE TO BE commended for drawing attention to the ethical responsibilities of life scientists whose work could impact bioterrorism ("Ethics: a weapon to counter bioterrorism," Policy Forum, 25 Mar., p. 1881). A point not given sufficient emphasis is the "professionalization of ethics," whereby a profession's commitment to a set of values and ethical standards reflects its interpretation of the world (*1*). This phenomenon tends to narrow the scope of moral evaluation to the exclusion of the experiences and needs of those who may be affected by the professional behavior (*1*). As a result, the profession's view of its role and responsibilities as embodied in its code of ethics risks becoming divorced from broader social values. To counter this tendency, it is critical that researchers engage nonscientists in the process of developing a code of ethics. A provision that acknowledges the critical role played by the public in developing a code of ethics for the life sciences (i.e., that obligates researchers to reach out to nonscientists when drafting the code) should be included together with a parallel provision that requires that the code be widely disseminated so that all those potentially affected by the research can have a basis for evaluating the conduct of scientists.

> "[I]t is critical that researchers engage nonscientists in the process of developing a code of ethics."
>
> –FRANKEL

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Reference

1. M. Frankel, *J. Business Ethics* **8**, 109 (1989).

IN THEIR POLICY FORUM "ETHICS: A WEAPON to counter bioterrorism" (25 Mar., p. 1881), M. A. Somerville and R. M. Atlas argue convincingly that physicians and scientists in the life sciences should adopt a code of ethics against bioterrorism and bioweapon research. They propose a code of ethics that urges physicians and scientists to "[c]all to the attention of the public, or appropriate authorities, activities (including unethical research) that there are reasonable grounds to believe are likely to contribute to bioterrorism or biowarfare." This clause begs the question: What if one's own government, which presumably represents the "appropriate authorities," funds and conducts bioweapons research?

Most biodefense-related research is paid for and done at the behest of national governments, rather than by private companies or terrorist groups (*1*, *2*). The "public" and "appropriate authorities" in the code of Somerville and Atlas should be amended to "national or international public" and "appropriate national or international authorities." Because bioterrorism and bioweapon proliferation are international issues, I believe that it would be entirely appropriate for any scientist to appeal to international institutions and world opinion, if he/she has reasonable grounds to believe that his/her government is engaged in activities that are likely to contribute to bioterrorism or biowarfare. Only by cooperation and mutual supervision among nations will we have a realistic chance of limiting bioterrorism and biowarfare.

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M. A. SOMERVILLE AND R. M. ATLAS ("ETHICS: a weapon to counter bioterrorism," Policy Forum, 25 Mar., p. 1881) are right to call for a code of ethics to govern the conduct of research in the life sciences, but those who heed their invitation should pause before the wheel is reinvented. In listing bodies that have spoken out about a need for ethics in the conduct of life sciences research, the authors have overlooked the Council on Ethical and Judicial Affairs (CEJA) of the American Medical Association (AMA).

CEJA has addressed this need, having issued ethical guidelines to prevent malevolent use of biomedical research (*1*), which were incorporated into the AMA Code of Medical Ethics (*2*) in June 2004. These guidelines call on biomedical researchers to balance their commitment to the advancement of scientific knowledge against the same "substantive and procedural principles of ethics" articulated by Somerville and Atlas, including commitment to the betterment of public welfare and safety and the importance of maintaining public trust. Moreover, building on the scientific traditions of individual and collective responsibility, the guidelines specify that scientists should strive to assess foreseeable ramifications of their research and that of their peers in an effort to balance the promise of benefit from biomedical innovation against potential harms from corrupt or unintended application of findings.

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*The views and opinions expressed are those of the author and should in no way be construed as representing official policies of the American Medical Association.

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1. E-2.078 Guidelines to Prevent Malevolent Use of Biomedical Research (available through the AMA online Policy Finder, at www.ama-assn.org/ama/noindex/category/11760.html).
2. American Medical Association Council on Ethical and Judicial Affairs, Code of Medical Ethics: Current Opinions with Annotations, 2004–2005 Edition (AMA Press, Chicago, 2004).

IN THEIR POLICY FORUM DISCUSSING THE ROLE of ethics in combating bioterrorism, M. A. Somerville and R. M. Atlas discuss the need for a code of conduct for scientists working in dual-use research areas ("Ethics: a weapon to counter bioterrorism," 25 Mar., p. 1881). For the 6th Framework Program (2002–06), the European Commission has adopted an ethics review process that considers classical ethical issues (like the use of human biological samples), human data protection, and animal testing as well as dual-use research (*1*).

Grant applicants are asked to consider dual-use aspects of their projected research (*2*). They must provide information on what dual-use implications they foresee, how to address these issues, and how relevant legal requirements will be met. The scientific reviewers of the proposals are also asked to reflect on ethical issues and to flag any sensitive areas. If the applicants and/or the scientific reviewers have indicated any ethical sensitive issues, the proposal undergoes an ethics review. An independent, multidisciplinary, multinational expert panel, including dual-use specialists, reviews the project proposal and provides recommendations to the funding institution and the applicants. These specialists are guided by EU-wide accepted international agreements, relevant EU legislation, and relevant national legislation (*3*).

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The experiences gained in this established, systematic, and institutionalized review process applied by the European Commission may provide relevant information to develop a best practices model to increase awareness of the dual-use problem and to enforce ethically sound research.

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M. A. SOMERVILLE AND R. M. ATLAS HAVE grossly oversold the use of ethics as a means of deterring the threat of bioterroism ("Ethics: a weapon to counter bioterrorism," Policy Forum, 25 Mar., p. 1881). A "Code of Ethics" similar to the one presented by the authors will not counter bioterrorism because it will be imposed on a scientific community that has no intent to conduct terror operations. The "dual-use" misnomer implies that biological scientists inadvertently develop weapons through their benign research efforts. In fact, bioterror plots are not hatched by benevolent scientists having a momentary ethical lapse; rather, they are the trade-craft of ruthless murderers who happen to have subverted the accomplishments of modern science. Bioterrorism is much more than the mere absence of ethical intentions; it is the highest crime perpetrated against humanity and is best addressed by aggressive law enforcement and intelligence efforts directed against would-be perpetrators. Imposing ethical standards on scientists as a means of curbing the use of biotechnology in terrorist plots will only demonize the scientific community.

Somerville and Atlas acknowledge that bioterrorists will not be deterred by a code of ethics. The enemy is a terrorist first and a scientist by convenience. His terroristic intentions compel him to offer his intellect to the will of his cause. The priority of cause over vocation in the many examples of scientists and doctors turned terrorist show that each was well aware of their "ethical obligations," but, undeterred by the oaths they took, chose killing over healing.

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"[B]ioterror plots are ... the trade-craft of ruthless murderers who happen to have subverted the accomplishments of modern science."
–PERMAN

IN "ETHICS: A WEAPON TO COUNTER BIOTERRORISM" (Policy Forum 25 Mar., p. 1881), M. A. Somerville and R. M. Atlas cite the Thomas Butler case as a purported example of unethical behavior by a scientist. They could better have used the case to show how ethical behavior can backfire on a scientist in an age of severe political pressures on antiterrorism agencies.

Butler would not be serving a 2-year sentence had he not voluntarily reported missing vials containing plague and had he not refused on principle to plead guilty to a false accusation of lying to federal authorities as proposed in a plea-bargain offer. Somerville and Atlas state that Butler reported missing vials and then "claimed that he had inadvertently destroyed the cultures" without mentioning

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that the second, contradictory statement was produced during an FBI interrogation in which Butler was in wrist irons connected to a metal waist belt, given a lie-detector test, and questioned for long hours without adequate food or sleep, and without legal counsel (waived by Butler in his wish to cooperate with authorities). Butler's self-contradiction under these circumstances led to a charge of lying (*1*) that enabled FBI officials to blame Butler for their costly actions in response to his initial report. His refusal to accept that charge led to the piling on of 54 additional charges (*2*), most derived from a dispute with his university over research contracts. The jury acquitted Butler of lying, the judge (*3*) praised his humanitarian and ethical behavior, and his former dean (*4*) has defended his use of funds.

Protests by scientists (*5*) do not imply "acceptance of [Butler's] breach of laws and regulations" as stated by Somerville and Atlas. A Code of Ethics for scientists and scientific institutions needs to reflect a better appreciation of the complex issues involved than shown by Somerville and Atlas in their discussion of the Butler case.

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2. Superseding Indictment, United States of America v. Thomas Campbell Butler, MD, United States District Court for the Northern District of Texas, Lubbock Division, filed 14 August 2003.
3. Transcript of sentencing hearing in the Thomas Butler Case (available at www.fas.org/butler/sentence.html).
4. B. E. Murray *et al.*, *Clin. Infect. Dis.* **40**, 1644 (2005).
5. P. Agre, S. Altman, R. Curl, T. Wiesel, "Statement regarding the case of Thomas Butler, Lubbock Texas" (Federation of American Scientists, Washington, DC, 2003) (available at www.fas.org/butler/nobellet.html).

Response

WE PROPOSED A CODE OF ETHICS TO COUNTER bioterrorism hoping it would stimulate dialog. As the Letters presented here attest, the code has caused people to think about the value of ethics and the need to act to protect science from misuse.

We welcome Frankel's points that the values and ethical standards enshrined in a code of ethics must reflect a broader spectrum that stretches well beyond those of a given profession and that the public must have a strong voice in deciding on these values and ethical standards. Ethics requires more than scientists just acting in good personal conscience, and the same is true of them acting collectively as a profession in good professional conscience. Rather, the broadest possible range of people and institutions must be involved in ethics decision-making.

The following are some of the ways in which we recognize the need to engage people outside science and, in particular, the public, in setting values and ethical standards for the life sciences: (i) In requiring ethics review of all research, we assume that, as is now the norm, any ethics committee would have a very broad-based membership. (ii) The concept we

> **"[T]he broadest possible range of people and institutions must be involved in ethics decision-making."**
>
> –SOMERVILLE AND ATLAS

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articulate, that the scientific professions hold science on trust for society, establishes that society has the final say as to what will and will not be allowed in terms of ethics. (iii) The code includes an express duty "to bring to the attention of the public or appropriate authorities" activities that are unethical or could contribute to bioterrorism or biowarfare.

As we indicated, providing for "whistleblowing" is an essential element in implementing a code. Li makes the important point that one's own government could (and would, unless procedures were put in place to avoid it) have a conflict of interest in receiving information about its own wrongdoing. In such cases, it would not be an appropriate authority to which, as the code requires, to report. Who would be appropriate must be determined on a case-by-case basis and might include a role for other national authorities or international ones, as well as the public.

We are aware of the developments in medical ethics that Green references and our code is indebted to them, but experience has shown that professional specificity of ethical requirements is needed for scientists to personally identify with them and, as a result, apply them in practice.

Rath and Jank provide an important example of the practical operationalization of a code of ethics. We can learn much from the European experiential ethics knowledge that has resulted, and it is important to identify and build on all presently existing relevant resources. In some cases, ongoing monitoring of ethics as the research evolves, a step not mentioned by Rath and Jank, is also required.

> **"Ethics is integral to science, which means that unethical science is bad science, not just bad ethics."**
>
> –SOMERVILLE AND ATLAS

Like democracy, our code will not instantiate a perfect system, but the right question is whether we are better off with it than without it. We strongly disagree with Perman that "[i]mposing ethical standards… will only demonize the scientific community," that scientists might not inadvertently "develop weapons through their benign research efforts," and that "aggressive law enforcement and intelligence efforts" are the only ways to counter bioterrorism and are not complemented by implementing ethics. Ethics is integral to science, which means that unethical science is bad science, not just bad ethics. Like all elements of good science, ethics must be intentionally included and a code helps ensure that. It assists scientists in fulfilling their ethical responsibility to help protect against the misuse of science by those who would do harm.

Given the division within the scientific community caused by the Butler case, we are not surprised by Agre *et al.*'s letter, which reminds us that good facts are essential to good ethics. Judging the ethics of certain situations can be highly complex, especially when the facts are in dispute, as Agre *et al.* say they are in the Butler case. We welcome their criticism because we recognize that engaging in ethical analysis in real cases is an exercise of power, and power must be exercised ethically. In short, ethicists must also be reminded that they must practice their profession—that is, "do ethics"—ethically. But our fundamental point remains unchanged—unless to do so would be unethical, scientists and their colleagues must recognize the responsibility to comply with agreed-upon regulations and laws even if government officials and others encourage them to do otherwise and even if the intent of the research is noble.

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In conclusion, the basis on which societal-level trust is established has shifted in postmodern Western societies from blind trust to earned trust (*1*). Earning trust requires openness, honesty, and integrity. It is a continuing process that requires the sharing of information and the informed consent of those who give their trust. Scientists must develop a manifest culture of responsibility to maintain the public trust upon which science depends.

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Madrid Center Not Quite in Limbo

IN HIS ARTICLE "MADRID HEART CENTER TO BE rescued" (8 July, p. 229), X. Bosch summarized recent news about the Spanish National Center for Cardiovascular Research (Centro Nacional de Investigaciones Cardiovasculares, CNIC). He states that "CNIC slipped into limbo in May 2004…" In this context, "limbo" seems to mean "a place or condition of oblivion or neglect" (according to *Webster's New World Dictionary*). However, many things happened within CNIC during the last year. A new administrative manager was hired by the government, and financial support to finish the building project was provided by the Ministry of Health. Scientific activity kept pace and resulted in several contributions that will hopefully stand evaluation by usual scientific criteria (see www.cnic.es/research.htm). Hence, we have trouble grasping the precise connotation of the word "limbo" as used by Bosch.

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CORRECTIONS AND CLARIFICATIONS

Letters: "Issue in Indian science" by S. Byravan (22 July, p. 557). Because of an editing error, the size of the Indian middle class was given as approximately 3 million people. It is approximately 300 million.

News of the Week: "Madrid heart center to be rescued" by X. Bosch (8 July, p. 229). Salvador Moncada's subject of study was incorrectly given as nitrous oxide; it is nitric oxide.

TECHNICAL COMMENT ABSTRACTS

COMMENT ON "Molybdenum Isotope Evidence for Widespread Anoxia in Mid-Proterozoic Oceans"

H.-F. Ling, J.-F. Gao, K.-D. Zhao, S.-Y. Jiang, D.-S. Ma

Molybdenum isotope data presented by Arnold *et al.* (Reports, 2 April 2004, p. 87) do not support their claim for a 10-fold change in oxic deposition area from mid-Proterozoic to present-day oceans. Our calculation using their model shows that euxinic area comprised only 3.7% of the oxic area in mid-Proterozoic oceans, which is not consistent with widespread anoxia.
Full text at
www.sciencemag.org/cg/content/full/309/5737/1017c

RESPONSE TO COMMENT ON "Molybdenum Isotope Evidence for Widespread Anoxia in Mid-Proterozoic Oceans"

A. D. Anbar, G. L. Arnold, T. W. Lyons, J. Barling

Ling *et al.* assume that molybdenum is removed only in oxic or euxinic (sulfidic) basins and that ocean bottom waters are either oxic or sulfidic. These simple assumptions ignore the importance of settings that are anoxic, or nearly so, but not sulfidic. Our conclusions are more consistent with plausible paleooceanographic interpretations.
Full text at
www.sciencemag.org/cg/content/full/309/5737/1017d