lished, available on toxicity to laboratory animals (such as mice, rats, and other model organisms) these data are not always easily translatable to effects on natural ecosystems. Large-scale comparisons among transgenic, conventional, and alternative agricultural practices provide the most direct approach to understanding the ecological risks and benefits and the variability of their magnitude.

L. LAREESA WOLFENBARGER,[1]* PAUL R. PHIFER[2]
[1]AAAS Environmental Fellow, U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, DC 20460, USA; [2]AAAS Diplomacy Fellow, U.S. Department of State, Bureau of Oceans, Environment, and Science, Arlington, VA 22206, USA
*To whom correspondence should be addressed. E-mail: llwolfenbarger@yahoo.com

The views expressed in this response are those of the authors and do not necessarily reflect the views or policies of either agency or the U.S. government.

References and Notes

1. L. P. Gianessi, J. E. Carpenter, *Agricultural Biotechnology: Insect Control Benefits* (National Center for Food and Agricultural Policy, Washington, DC, 1999), available at http://www.bio.org/food&ag/ncfap/ag_bio.htm
2. G. A. Carlson, M. C. Marra, B. J. Hubbell, *Proc. Beltwide Cotton Conf.* 2, 973 (1998).

Risk Assessment Data for GM Crops

THE POTENTIAL ENVIRONMENTAL RISKS AND benefits of genetically modified (GM) crops "vary spatially, temporally, and according to the trait and cultivar modified," L. L. Wolfenbarger and P. R. Phifer emphasize in their Review (*Science*'s Compass, 15 Dec., p. 2088). The same is true for conventionally derived cultivars. Biotechnology crops are not inherently less safe than their conventional counterparts. Formal scrutiny and regulation before and after commercialization should ensure that these crops maintain their status of "as safe as" or safer than conventional crops. With the vast array of potential risks of all new cultivars, priorities must be set to identify those cultivar-trait combinations that require supplemental data to facilitate the decision-making process.

The authors focus exclusively on peer-reviewed data in the scientific literature and ignore the majority of data—that data reviewed by regulatory agencies and their independent advisors. Wolfenbarger and Phifer's suggestion as to the quantity and quality of information that should be generated not only ignores the need to set priorities but also does not acknowledge a successful history of reliance on risk assessments that use representative populations and added conservative assumptions to address uncertainties.

A target pest for GM crops, the European corn borer.

"...scientific data alone cannot address a public's concern over biotechnology."

Cooperation among a range of public and private institutions in agricultural biotechnology will be needed to fill gaps in data that are necessary to the decision-making process. Such a pact would alleviate two major constraints to progress: inadequate resources to support research, and a public lack of trust in agricultural biotechnology and those who develop and regulate it. To better deal with these issues in the public arena, an independent, multi-stakeholder, peer-review process should be created in countries where it is not already in place; where it does exist, such as in the United States and Canada, additional mechanisms to increase public understanding and awareness are needed. Our most important lesson from global discussions on new technologies is that while data alone cannot address cultural, economic, and ideological differences, we can ill afford to ignore valid data when assessing the impact of such technologies.

PETER GREGORY,[1]* KLAUS VON GREBMER,[2] ORLO EHART[3]
[1]Novigen Sciences, Inc., 1730 Rhode Island Avenue, NW, Washington, DC 20036, USA. [2]International Food Policy Research Institute, 2033 K Street, NW, Washington, DC 20006, USA. [3] Next Wave Enterprises, 2507 Forest Glen Road, Silver Spring, MD 20190, USA
*To whom correspondence should be addressed. E-mail: pgregory@novigensci.com

Response

WE CONDUCTED A THOROUGH REVIEW OF published literature and unpublished reports on transgenic organisms in the public domain during our research, compiling between 300 to 400 freely available papers and reports. The small number of unpublished studies included in our review were chosen because they both augmented areas of research lacking extensive published data and described their methods in sufficient detail as to make them repeatable. Most of the unpublished studies we reviewed did not contain significant data or did not describe their methods in detail. However, we did not request unpublished data submitted to regulatory agencies; thus, we are unable to comment on the quality or quantity of these data. Publication of any applicable data in the scientific, peer-reviewed literature would facilitate their entrance into the public dialogue concerning the benefits and risks of GM plants.

We did identify in our *Science* Review gaps in research that will require a large quantity of high-quality data, and, admittedly, significant resources to address. Furthermore, we do not disagree that representative populations and conservative assumptions are an important component of risk assessments; however, we might differ in what we would define as an appropriate representative population. We would stress ecologically relevant populations because ecological comparisons between a GM crop and its alternatives will provide the key evidence for understanding relative environmental risks and benefits. Given the differences among ecosystems, not all ecological risk assessment data can be applied to all countries, yet we can provide a model of what data will best address these issues.

We support Gregory *et al.*'s advocacy for science-based assessments of the potential benefits and risks of GM products and agree that scientific data alone cannot address a public's concern over biotechnology. We also believe that it is important the public is given valid, comprehensive, and understandable summaries or analyses of complex scientific issues, which is what we have attempted to provide.

L. LAREESA WOLFENBARGER,[1]* PAUL R. PHIFER[2]
[1]AAAS Environmental Fellow, U.S. Environmental Protection Agency, Office of Research and Devel-

CREDIT: DONALD SPECKER/ANIMALS ANIMALS

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 by e-mail (science_letters@aaas.org), the Web (www.letter2science.org), or 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.

opment, National Center for Environmental Assessment, Washington, DC 20460, USA; [2]AAAS Diplomacy Fellow, U.S. Department of State, Bureau of Oceans, Environment, and Science, Arlington, VA 22206, USA
*To whom correspondence should be addressed. E-mail: llwolfenbarger@yahoo.com

Conflicts of Interest

I TAKE EXCEPTION TO ELIOT MARSHALL'S characterization of both the recent action by the Office for Human Research Protection (OHRP) in circulating its "draft interim guidance on financial relationships in clinical research" and the response of the academic community (News of the Week, "Universities puncture modest regulatory trial balloon," 16 Mar., p. 2060). Notwithstanding its appellation, and whether "mildly worded" or not, the document was equivalent to a notice of proposed rulemaking, and the academic community reacted with appropriate gravitas to express its concerns, as it would with any other proposed federal rule. For its part, the Association of American Medical Colleges' (AAMC's) response to OHRP focused on the matter of institutional financial relationships—which represent totally unexplored terrain—where we believe the guidance was, in fact, premature.

Despite a seeming rush to judgment by political leaders and the media based on a few anecdotal reports, convincing empirical evidence that investigators' (or institutions') related financial interests in their research pose a significant threat to the integrity of that research is lacking. So the academic community, as well as federal research sponsors, must deal largely with

> **"...academic medical centers are caught up in a conflict of public expectations..."**

perception, rather than a well-defined problem. Complicating the matter further, universities and their academic medical centers are caught up in a conflict of public expectations: these institutions are increasingly valued as "engines of economic growth," but at the same time are expected to maintain a flawless public posture as independent creators and arbiters of knowledge.

AAMC recognizes its responsibility for guiding its member institutions in these matters. We and the Association of American Universities, individually and in tandem, are acting to clarify the issues and develop consensus that can inform academic policy as well as federal rule-making. The new AAMC Task Force on Financial Conflicts of Interest in Clinical Research (www.aamc.org/newsroom/pressrel/010329.htm) has been constituted to ensure that all stakeholders are at the table, not only medical school and teaching hospital leadership and prominent clinical investigators, but also industry executives, ethicists, attorneys, media representatives, and patient advocates. In conducting this exercise, the safety of our patients and research volunteers will remain our highest priority.

DAVID KORN
Senior Vice President, Biomedical and Health Sciences Research, AAMC, 2450 M Street, NW, Washington, DC 20037–1127, USA

Human Cloning—Not If, but When

THE QUESTION OF WHETHER to clone human beings is one that does not need an answer. Now that the technology exists, it will be done. The better question may be, will human cloning be done with the support of the public in professional research facilities or in the confines of secret basement laboratories?

R. Jaenisch and I. Wilmut, in their Policy Forum "Don't clone humans!" (*Science*'s Compass, 30 Mar., p. 2552), raise many concerns about the imperfections in the technology of cloning humans. As long as there is a demand for the product and the possibility exists for success in this technology, it will be explored.

The ethical questions that arise concerning cloning will have to be addressed, just as ethical questions are dealt with for any controversial issue. For example, once the technology required to manufacture high-speed automobiles was available, the question of whether to produce these automobiles became irrelevant. It was done. The automobile became a useful convenience, but with its usefulness also came the possibility of misuse, creating hazards that previously did not exist. Questions of the ethics of putting such a powerful tool as an automobile in the hands of human beings gave rise to more issues, such as new safety concerns and regulations for its use on the road.

New technology is always followed by controversial issues, bringing forth new concerns requiring new solutions. Questions of how best to use the technology of human cloning while minimizing the risk of misuse should be faced now.

GEETA CHOUGULE
110 Juniper Drive, East Greenwich, RI 02818, USA. E-mail: connectmet@aol.com

I APPLAUD JAENISCH AND WILMUT'S STRONG argument against human reproductive cloning; however, I wish they would have elaborated on the "many social and ethical reasons why [they] would never be in favor of copying a person," to which they allude. The issues of experimental safety to which they devote the bulk of their argument may become moot in the not-so-distant future. For instance, researchers seeking to transform adult cells into an embryonic-stem-cell-like state, for therapeutic transplantation, might uncover the secret to genomic reprogramming that currently bedevils efforts at animal cloning. In the meantime, the danger for opponents of human cloning is that the ethical argument might focus exclusively on the safety of the procedure: once it becomes safe, it will therefore appear permissible.

The reputation of physics suffered because of the apparently unreflective involvement of so many physicists in the Manhattan Project. In the case of the atomic bomb, however, researchers could plausibly claim that the urgency of war swept aside their moral qualms. Where is the urgent need for human clones? Whether human cloning becomes a reality, future generations will judge scientists more kindly if we make a stand against it on grounds of universal morals, rather than leave such concerns to flak-catching bioethicists.

CHARLIE MURTAUGH,
Department of Molecular and Cellular Biology, Harvard University, Cambridge, MA 02138, USA. E-mail: murtaugh@fas.harvard.edu

CORRECTIONS AND CLARIFICATIONS

THIS WEEK IN SCIENCE: (30 Mar., p. 2511). The image erroneously printed with the item "Mapping out bond formation" should have appeared with "Bosons help cool Fermi gases."

REPORTS: "A sperm cytoskeletal protein that signals oocyte meiotic maturation and ovulation" by M. A. Miller *et al.* (16 Mar., p. 2144). In the second line from the bottom of the caption for Figure 1, the number "14,1475" should have been printed as "14,147.5."

CREDIT: CAMERON SLAYDON