

This letter-to-the-editor was published in the 3 Sept 99 issue of *Science*.

Re: "Facing Fear of Biotechnology" editorial, 16 July 1999

10 August 1999

To the Letters Editor of Science:

Dr. Roger N. Beachy bewails the "hysteria" and "mistrust" that have led many Europeans to disbelieve U.S. official findings that genetically altered foods are safe for both eaters and ecosystems. A simpler explanation would be the widespread and justifiable perception that key committees, agencies, and policy positions have been captured or compromised by commercial interests.

Ex-regulators reviewing their own past decisions, and consultants to or former employees of the industries being scrutinized, do not look independent. Neither do studies performed or sponsored by those industries, especially if unpublished. Old, narrow, superseded science and lack of relevant disciplinary backgrounds may make findings unconvincing. Revolving-door appointments tarnish the appearance of integrity in policy advice. Such conditions, widespread in U.S. and for that matter U.N. food regulation, rationally explain weak public confidence. Dr. Beachy regrettably contributes to this problem by failing to note that a leading transgenics company is a cofounder and major funder of his institution, whose genuine independence, despite its university and nonprofit partners, remains to be established.

The "comprehensive scientific reviews" which Dr. Beachy claims ensure food safety look very different to readers of a recent report [1] that USDA, EPA, and FDA all lack jurisdiction to test and certify the safety of genetically modified foods. FDA, for example, doesn't test the safety of genetically altered potatoes because EPA regulates the *Bacillus thuringiensis* (*Bt*) insecticide they produce. (Companies can opt out of FDA regulation of other transgenic foods simply by saying they're safe.) EPA doesn't follow FDA's food standard, "reasonable certainty of no harm," but sets human tolerances subject to risk-benefit analyses. But EPA doesn't test the potatoes either; it merely feeds separately produced *Bt* insecticide to mice and assumes the potatoes are otherwise identical (an assumption now coming into question for soybeans [2]). Purchased, the insecticide comes with a long EPA warning label, but eaten in potatoes, it's unlabeled, because FDA, which controls plant-food labels, is barred by law from including on them any pesticide information. Nonetheless, the potato vendor's spokesman is quoted as saying that his firm "should not have to vouchsafe the safety of biotech food. Our interest is in selling as much of it as possible. Assuring its safety is the F.D.A.'s job." Why should this runaround inspire public confidence either? And who, if anyone, ensures ecological safety, which may be an even greater concern [3]?

Genetically altered crops are being rejected by many leading international buyers, and trade at a discount [4], doubtless due to fear and risk-aversion. But fear is not always irrational, especially when so many of the surprises have been bad ones. Dr. Beachy is right that the basis of concern needs scientific clarification. However, both transgenics and science will lose legitimacy if cheerleading replaces thoughtful and rigorous discussion of food and ecosystem safety, especially from the commonly missing perspectives of ecology and evolutionary biology.

For example, how is injecting a fish gene into a strawberry or a frog gene into a potato like or unlike the traditional breeding of closely related plants? Can transgenics enable pathogens to jump the species barrier? Is horizontal gene flow faster with transgenes, and if so, why? Are antibiotic-resistance markers and viral carriers potentially problematic? How do we really know that genetically altered foods are and will remain "substantially equivalent"? If evolution, as a fundamental process, occurs even at the "nanoecosystem" scale of the genome, then are so-called "junk genes" its biodiversity, not to be casually discarded or ignored? Exactly how do genomic and environmental context influence expression in the phenotype? What are the potential consequences of ignoring that context, and of injecting alien genes from wholly unrelated taxa into random locations in the genome?

And now for the tough, fundamental questions: What would be the long-term ecological implications of success in creating the properties being sought? Is redesigning evolution to work not at its biological pace but at that of quarterly earnings reports and to align not with biological fitness but with economic profitability (survival not of the fittest but of the fattest) really a good idea? Can it still foresee and forestall? Can novel life forms with unexpected consequences be reliably recalled? Is transgenics, as Robert Sinsheimer said of nuclear fission, "a fit technology for a wise, farseeing, and incorruptible people"? And is transgenics really essential to avoiding starvation or is it, as nuclear power proved to be, just a distraction from available, superior, but systematically suppressed and overlooked alternatives [5]?

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References and Notes

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2. For example, M. Lappe, E.B. Bailey, C. Childress, K.D. R. Setchell, *J.Medic. Food* 1,241 (1998/1999).
3. J. Rissler and M. Mellon, *The Ecological Risks of Engineered Crops* (MIT Press, Cambridge, MA, 1996).
4. T.S. Ramey, M.J. Wimer, R.M. Rucker, "GMOs are dead" (Deutsche Bank Research, New York, 21 May 1999).
5. A .B. Lovins and L.H. Lovins, *St. Louis Post-Dispatch*, 1 August 1999, condensed from "Atale of two botanies," posted at www.rmi.org/store/pid82.asp; G. Conway, *The Doubly Green Revolution* (Penguin, Harmondsworth, UK, 1997); National Research Council, *Alternative Agriculture* (National Academy Press, Washington, DC, 1989); *Lost Crops of Africa*, vol. 1, *Grains* (National Academy Press, Washington, DC, 1996); P. Hawken, A. B. Lovins, L. H. Lovins, *Natural Capitalism: Creating the Next Industrial Revolution* (Little Brown, New York, 1999) esp.chap.10.

Editorial writer Beachy is identified as president of the Donald Danforth Plant Science Center in St. Louis, Missouri. But he does not inform us that for many years he has collaborated with, and been financed by, the Monsanto Corporation (1), a leader in corporate plant biotechnology and the subject of much criticism in this area (2). The Monsanto Corporation is a founding partner of the Donald Danforth Plant Science Center (3). In addition, Beachy chairs the Scientific Advisory Board of Xyris, another agricultural biotechnology firm (4). These significant corporate involvements and their consequent biases cannot be inferred from his stated affiliation. As Beachy notes, plantings of genetically modified crops have increased dramatically over the past few years. He asserts that the commercial use of such crops followed "comprehensive scientific reviews." Others refute this statement. Beachy's pro-Monsanto biases are revealed by his not acknowledging the arguments of reputable scientists and biotechnology policy analysts that the reviews have in fact been minimal, short-term, and conducted by industry (and largely unpublished, rather than public and peer reviewed) and that they have not addressed the full range of risks posed by these novel organisms (5). Differing views about the risks of genetically modified crops are thus matters of scientific debate (6). However, by posing the issue in terms of "hysteria" and "fear of biotechnology," Beachy uses his position as editorialist to obstruct essential technical and public discourse.

As a matter of policy, *Science* should follow the practice of other scientific society-sponsored journals (7) by requiring that all authors and editorialists fully disclose financial interests in their subject matter. Only then can readers knowledgeably evaluate the writer's statements and potential biases.

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References and Notes

1. R.N. Beachy, *The Scientist*, **4**, 15 (1990); www.the-scientist.lib.upenn.edu/yr1990/july/opin1-900723.html
2. For example, D. Baroza, *N.Y. Times*, 5 August 1999, p.C1.
3. danforthcenter.org/partners.htm
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7. D. Rennie, A. Flanagan, R. M. Glass, *J. Am. Med. Assoc.* **266**, 266 (1991).

Response

Lovins questions the conclusion that current regulatory mechanisms are sufficient to oversee foods developed through genetic modification. The fact is that the FDA has absolute legal right over the foods developed by any process. New varieties produced by means of biotechnology must be shown to possess chemical equivalence with the parent materials; such proof is provided by the company making application. After review (generally requiring 12 to 18 months), the FDA rules to accept or reject; it also holds the right to remove any food product at a later date. The EPA evaluates the environmental safety of any new pesticidal product (such as the *Bt* protein), and sets daily allowances of residues of the protein and/or its derivatives in the food or in the environment. The USDA determines whether the new variety does or does not have impacts on the ecology of the environment in which it is planted and, accordingly, determines acceptability. These processes together can require up to 6 years to gain approval of a new variety developed by genetic transformation. Such requirements are not required of varieties produced by chemical or radiation mutagenesis, or by other techniques used in plant breeding.

Lovins and board members of the Council for Responsible Genetics question the independence of the Donald Danforth Plant Science Center. Legal documents that establish the Center are open to the public and confirm the independence from Monsanto Company and other companies. I would not have accepted the position as president and director of the center under other conditions. Like the authors of the letters, I, too, believe in full disclosure. I am currently a member of the Science Advisory Board of Akkadix, in San Diego, a newly established corporation, and Advisor for Biotechnology for the Rohm and Haas Corporation, in Philadelphia. I have not received support for sponsored research from the Monsanto Company since 1991 and have served only as an ad hoc consultant. I have served as an ad hoc consultant and advisor for a variety of other biotechnology companies since 1982.

I respect the right of others to disagree and expect all reputable scientists to present accurate information and honest conclusions. Regardless of the differences of opinions expressed in these letters, I believe that all can agree that the more scientists learn about plants, both within or outside of agriculture, the greater the likelihood that we will develop sustainable methods to meet the challenges of a growing population.

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