

LETTERS

edited by Jennifer Sills

Seeds of Change for Restoration Ecology

FORESTS PROVIDE A WIDE VARIETY OF ECOSYSTEM SERVICES, INCLUDING PROVISIONS SUCH AS food and fuel and services that affect climate and water quality (1). In light of the increasing global population pressure, we must not only conserve, but also restore forests to meet the increasing demands for ecosystem services and goods that they provide (2). Ecological restoration has recently adopted insights from the biodiversity-ecosystem function (BEF) perspective (3). This emphasis on functional rather than taxonomic diversity (3, 4), combined with increasing acceptance of perennial, global-scale effects on the environment (5, 6) and the associated species gains and losses (“Terrestrial ecosystem responses to species gains and losses,” D. A. Wardle *et al.*, Review, 10 June, p. 1273), may be the beginning of a paradigm shift in forest conservation and restoration ecology. As a result, we may see increased tolerance toward and the use of nonnative tree species in forests worldwide.

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7. R.A. was supported by a postdoctoral fellowship of the Research Foundation–Flanders (FWO).

Manufacturing Decline
Yields Drug Shortages

FROM OUR VANTAGE POINT WITHIN THE WORLD of pharmaceutical development and manufacturing, we welcome your effort to draw attention to shortages of the irreplaceable cancer drug cytarabine (“Shortages of cancer drugs put patients, trials at risk,” J. Kaiser, News & Analysis, 29 April, p. 523). The scarcity of not only cytarabine, but also numerous other drugs, is an urgent public health problem that both the drug industry and the

government have an obligation to address. To do this successfully, both the causes and the solutions of this issue need to be understood in their broader context: the neglect of manufacturing, especially high-tech manufacturing, in the United States.

The proximate cause of the most recent cytarabine shortage was a failure of production. However, what turned this error into a tragedy was a failure of the market. As the News story explains, the profit margin on generic drugs such as cytarabine is often very small. At the same time, the technical and

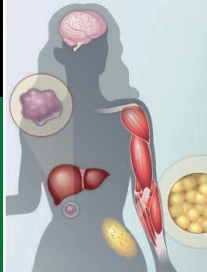
regulatory burden—especially for cytotoxic sterile injectibles (again, like cytarabine)—is as substantial as it is for extremely profitable, brand-name drugs. Few businesses could be expected to enter such a market, and indeed, few have.

In this respect, the pharmaceutical industry is far from exceptional. Business leaders like Andrew Liveris (CEO, Dow Chemical), Michael Porter (founder, Monitor Group), and Andy Grove (CEO, Intel) have sounded the alarm at the decline of America’s manufacturing capacity. They note that manufacturing has a tremendous multiplier effect on economic growth and job creation (1–3). Nonetheless, a perfect storm of laissez-faire public policy and bottom-line business decisions has allowed the sector to atrophy. Constituents of both the public and the private sectors work under the mistaken belief that American firms can continue to innovate domestically while leaving manufacturing to someone else. The flaws in that logic are evident in our industry. We have seen that R&D and manufacturing are most effective when communication is reciprocal, the lessons learned in the plant feeding back to the drawing board (or the lab bench) (4). As a result, in many industries, where manufacturing goes, innovation tends to follow.

The cytarabine shortage shows us that the wasting away of the U.S. manufacturing sector may not just shut us out of future prosperity; it can actively do harm in the present day. Today, across the United States, patients with leukemia are being told that they can’t have the one drug that could extend or save their lives.

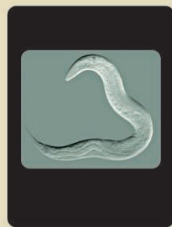
Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the past 3 months or matters of general interest. Letters are not acknowledged upon receipt. Whether published in full or in part, Letters are subject to editing for clarity and space. Letters submitted, published, or posted elsewhere, in print or online, will be disqualified. To submit a Letter, go to www.submit2science.org.



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and cancer

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We join with Liveris, Porter, and the like-minded thinkers mentioned in the News story in their call for more meaningful government incentives to make manufacturing in the United States a logical choice. Targeted incentives can be an investment not only in the future of the economy, but in the future of individual Americans as well.

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NSF's Struggle to Articulate Relevance

PUBLIC SCIENCE TODAY FINDS ITSELF CAUGHT between competing demands: Researchers need autonomy to pursue questions wherever they lead, whereas funders demand that research meet societal needs. The National Science Foundation (NSF) offers a case study of the balancing of scientific autonomy and societal accountability. NSF is charged with funding basic (i.e., nonmission) research. Yet Congress funds basic

science in the hope that societal benefits will result. In 1997, NSF added a "broader impacts" review criterion to address concerns about relevance: Justify research in terms of societal outcomes.

Over the past decade our nation's concern with accountability has increased, and in response, the NSF recently issued new draft criteria for the review of submitted proposals (*J*). The new plan will require researchers to identify the broader good of their research by selecting from a list of national priorities. No doubt, scientists who complained about the vagueness of the "benefits to society" clause in the former criterion will welcome the proposed changes as providing much-needed clarity and direction to the idea of "broader impacts." But specifying impacts raises three potential problems.

First, the list focuses on economics and national security, but excludes protecting the environment and addressing other social problems. Aside from the consequences of neglecting these areas, this new focus may undermine the attractiveness of STEM disciplines to more idealistic students who are interested in meeting human needs rather than foster-

ing economic competitiveness. Second, under the proposed new criteria, applicants and reviewers are restricted to the provided list of national needs, which will complicate efforts to respond to new challenges as they develop. Third, addressing these national needs is now supposed to happen “collectively.” This reopens the question of whether each individual proposal must address broader impacts. The new criterion thus replaces vagueness regarding what counts as a broader impact with vagueness regarding who is responsible for addressing broader impacts.

The new criteria are not without merit. For example, the guidelines on how to implement proposed broader impacts are improved. Once one identifies the national goal to be pursued, the new broader impacts criterion focuses on logistical questions that should be asked in peer review.

The proposed changes in the merit review criteria move too far in the direction of accountability, at the cost of scientific creativity and autonomy. The set of principles (in terms of national goals) also suffers from excessive detail at the cost of flexibility. Of

course, revising the criteria is a perennial process of renegotiation as cultural values change, and these are only draft criteria and principles. NSF invites comments until 14 July. Both the scientific community and the science policy community need to make their voices heard.

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Reference

1. National Science Board, “NSB/NSF seeks input on proposed merit review criteria revision and principles” (http://nsf.gov/nsb/publications/2011/06_mrtf.jsp).

CORRECTIONS AND CLARIFICATIONS

Reports: “Realizing all-spin-based logic operations atom by atom” by A. A. Khajetoorians *et al.* (27 May, p. 1062). The following errors were introduced during proofs. On page 1063, the third complete sentence should read, “In the next step, the spin lead is built atom-by-atom by subsequently adding Fe atoms with an interatomic distance $d = 0.923$ nm, where the interatomic exchange coupling is antiferromagnetic ($|J| \gg 0.1$ meV) (Fig. 2, A to E) for spin leads with lengths of

up to six atoms.” On the same page, the third sentence of the second complete paragraph should begin, “Given that the exchange interaction between each spin lead and its island J_{isl} dominates, and that the mutual interaction between the end atoms in both leads is smaller than J_l , which is...” The caption above Table 1 should read, “Possible logical operations as a function of the relative orientation of biasing field and tip magnetization, and of the parity of each spin lead.” On page 1063, third column, second paragraph, the equation in the third sentence was incorrect. The correct equation is $B_{crit} = -J_{\alpha} + J_{\beta}/m \approx -0.05$ meV/3.5 $\mu\text{B} = -0.25$ T.

News Focus: “New work reinforces megaquake’s harsh lessons in geoscience” by R. A. Kerr (20 May, p. 911). The story gave incorrect URLs for three *Science* papers it cited. The correct URLs are www.sciencemag.org/content/early/2011/05/18/science.1206731 (Simons), www.sciencemag.org/content/early/2011/05/18/science.1207020 (Ide), and www.sciencemag.org/content/early/2011/05/18/science.1207401 (Sato). The online HTML version has been corrected.

Education Forum: “Inquiry-based writing in the laboratory course” by C. Moskowitz and D. Kellogg (20 May, p. 919). Two similar sentences appear in the first column on page 920. One was mistakenly included when a correction was made. The correct sentence is: “Now, imagine that students are given, at random, either contaminated or uncontaminated reagents, but they do not know who received which.”

Letters: “Counting India’s wild tigers reliably” by K. U. Karanth *et al.* (13 May, p. 791). The photo credit should have been “Pallava Bagla.”

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