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 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.

Tracking Children's Health to Age 21

IN HER ARTICLE "EVERYTHING YOU WANTED TO know about children, for $2.7 billion" (News Focus, 11 July, p. 162), Jocelyn Kaiser reports varying perspectives, negative as well as positive, on the planned National Children's Study. As Kaiser notes, the National Children's Study is an extremely ambitious project. It plans to follow 100,000 children in all areas of the United States from conception through the age of 21. Its goal is to comprehensively assess the impact of early exposures—physical, chemical, biological, and social—on growth, development, and life-long health. It offers an unparalleled opportunity to unravel the interplay of environmental and genetic factors in the causation of such conditions as asthma, childhood cancer, reproductive problems, and neurodevelopmental disorders.

As longtime proponents of the study, we have heard the criticisms and the praise reported by Kaiser many times. And while we acknowledge that the plan for the study is very ambitious, we believe, frankly, that this bold reach will be the key to its success. A project of this scope requires the expertise of scientists from multiple disciplines and sectors, and the planning process is naturally unwieldy. But that is far preferable to a limited, narrow short-term study that can examine only one or a few factors at a time.

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The National Children's Study will track children's health from conception to age 21.

We believe that it would be incredibly shortsighted to put off this study because of its high cost. The study's price tag is dwarfed in comparison to the cost of treating diseases and disabilities associated with low birth weight and preterm birth, asthma, diabetes, and obesity. This is why we have urged the President and Congress to make funding available. We anticipate that information from this study will help pediatricians treat childhood diseases and help guide child environmental health policy over the next generation. Costs need to be weighed in terms of value gained.

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Agricultural IP and the Public Sector

IN THE CURRENT GLOBAL MARKET, A country's economic success relies on its effectiveness in constantly seeking out and utilizing new knowledge and technologies. There is a growing concern, however, that overly stringent intellectual property protection might hamper the progress of academic research.

To overcome these obstacles and to advance research on small specialty crops in the United States, various nonprofit U.S. institutions are promoting the establishment of the Public-Sector Intellectual Property Resource for Agriculture ("Public sector collaboration for agricultural IP management," R. C. Atkinson *et al.*, Policy Forum, 11 July, p. 174). These institutions suggest that this initiative to establish a collective intellectual property management framework will also benefit subsistence crop research in developing nations.

Although it may be true that this initiative could benefit research in developing nations, the reality is that the strategies are not specifically designed to address the agricultural needs of developing countries. They are designed to address U.S. concerns.

In the context of intellectual property rights for biotechnology inventions, developing countries face locally specific problems relating to biosafety, biodiversity, unfair exploitation of genetic resources and traditional knowledge, and the equitable sharing of benefits. In addition, although access to new technology and intellectual property rights management are necessary for advancing research in neglected crops in the Southern Hemisphere, they are not by themselves sufficient.

In the thrust toward globalization, numerous developing countries are being urged to implement intellectual property legislation built on models created by more advanced economies, with little relevance to their own needs and stages of development. Indeed, it could be argued that intellectual property rights in biotechnology may only benefit monopolistic tendencies while widening the technological gap between developed and developing countries.

> **"... developing countries are being urged to implement intellectual property legislation built on models created by more advanced economies, with little relevance to their own needs and stages of development."**
>
> *–HUETE-PÉREZ*

Therefore, although the efforts of the Public-Sector Intellectual Property Resource for Agriculture might successfully address public-sector concerns, a better way to advance agricultural research in the interest of the developing world would be to support regional biotechnology development centers. Using locally designed models, these centers would address issues pertaining not only to intellectual property rights, but also—most importantly—to capacity building, technology transfer, and strategic alliances across nations.

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IN THEIR POLICY FORUM "PUBLIC SECTOR collaboration for agricultural IP management" (11 July, p. 174), R. C. Atkinson and colleagues offer a welcome expectation—and the first glimmer of hope—that academic institutions may yet marshal themselves to moderate the growing "anticommons" (*1*) in biological research to which they are major contributors. The circumstances reported for

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public-sector agricultural R&D exemplify the Heller-Eisenberg thesis that a growing thicket of upstream intellectual property claims would encumber research in a "spiraling cycle" of transaction costs and inhibit downstream innovation (*1*).

Tellingly, the article does not mention the option of establishing by consensus a class of precompetitive biological research that should remain in the public domain, as has happened in other R&D sectors (*2*). In biomedical research, NIH's guidelines on the sharing of "research tools" at least foster such considerations (*3*). The 1980 Bayh-Dole Act and Supreme Court decision in *Diamond v. Chakrabarty* are cited by Atkinson *et al.* among the fundamental changes in "the nature and ownership of innovations… [that] have complicated the mission of our public research institutions." True. But as NIH has noted, the Bayh-Dole Act does not require the products of federally funded research to be patented [the statute was further amended in 2000 specifically to discourage "unduly encumbering future research and discovery" (*4*)], and neither Bayh-Dole nor Chakrabarty precludes nonprofit institutions, individually or collectively, from adopting policies to ensure that their basic science discoveries remain freely accessible to researchers.

> **"… we agree… that there is a need for many other types of efforts to fully address the complex issues associated with the safe and appropriate use of new technologies to help… communities in developing countries improve their livelihoods."**
>
> – CONWAY & RAPSON

Bold examples of public and public-private initiatives to protect public domain knowledge include the Human Genome Project, the SNPs Consortium, the HapMap Project, and the Protein Structure Initiative, which stand as model efforts to counteract the "patent rush" (*5*) that threatens to engulf biomedical research and even clinical medicine. More such initiatives are sorely needed, given the relentless trend of U.S. patent law and practice in the past 20 years to push the boundaries of "patentable subject matter" ever further upstream in the R&D pathway and deeper into the heart of academic science and technology.

Eisenberg and Heller warned of the consequences of this trend, and Atkinson *et al.* describe its actualization in BioAg. The problem posed by "more than 40 patents and contractual obligations" encumbering commercial development of one new strain, "Golden Rice," may magnify manyfold in biomedicine as powerful gene-array technology or suites of gene-based diagnostic tests are developed. Surely, there is a better way to promote biomedical research and development for public benefit than to permit its rampant atomization and balkanization to continue unmitigated.

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Response

WE AGREE WITH HUETE-PÉREZ THAT DEVELOPING countries need better mechanisms to ensure the protection of their own resources and of new technologies they develop, and that IP legislation built on models from

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advanced countries may not be appropriate. The Rockefeller and McKnight Foundations have for many years supported crop biotechnology, capacity building, and technology transfer as part of a much broader set of strategies to help reduce poverty and hunger in developing countries. Constraints on IP associated with these programs led us to facilitate U.S. public-sector institutions in the establishment of the Public-Sector Intellectual Property Resource for Agriculture (PIPRA). Although we recognize that PIPRA cannot address all of the complex IP issues facing developing countries, we expect it to help, particularly with technology transfer and building IP capacity for more equitable partnerships. For example, PIPRA aims to develop educational tools for IP management, some targeted to the specific needs of developing countries. In addition, although PIPRA presently involves only public-sector institutions in the United States, if initially successful, participation may be broadened to involve similar institutions abroad, including those from the developing world.

It is true, as Huete-Pérez points out, that another major aim of PIPRA is to implement better public-sector management practices for IP relating to agricultural biotechnology to promote greater freedom to operate for improvement of specialty crops within the United States. However, the practice of licensing technologies to large corporations only for uses specifically needed by the corporations (for development of large-scale commercial crops) will also help ensure that these public-sector technologies will be available for use on crops important to the developing world. As foundations involved in support of agriculture in the developing world, we have experienced the difficulties faced in obtaining access to critical IP needed for projects involving biotechnology, and our support for PIPRA has been guided by the belief that it represents a promising new mechanism to help keep the results of public-sector research available for such efforts. Yet we agree with Huete-Pérez that there is a need for many other types of efforts to fully address the complex issues associated with the safe and appropriate use of new technologies to help poor people and communities in developing countries improve their livelihoods.

We also find much to agree with in the Letter by Korn and Heinig. In this regard, we note that our conversations and meetings with representatives from the institutions involved in PIPRA confirm that a major goal of this new initiative is indeed to do all possible to ensure that scientific discoveries and resulting technologies remain freely accessible to researchers. As mentioned in our Policy Forum, PIPRA participants aim to carefully weigh the option of disseminating discoveries via open publication versus the option of seeking patent protection. In the latter case, one of PIPRA's main goals is to promote the use of nonexclusive licensing or of limiting exclusive licenses to appropriately narrow fields of use. Such policies are very much in accordance with NIH guidelines.

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Forgery: Prediction's Vile Twin

AS EARLY AS 1830, CHARLES BABBAGE DISTINguished the following four kinds of scientific misconduct (*1*). Trimming is the smoothing of variation around the mean of a data set, in order to make it look extremely accurate. Cooking data is the omission of data sets (replicates) that do not fit one's expectations, or fudging around with constants in formulae until the results fit one's expectations (*1*).

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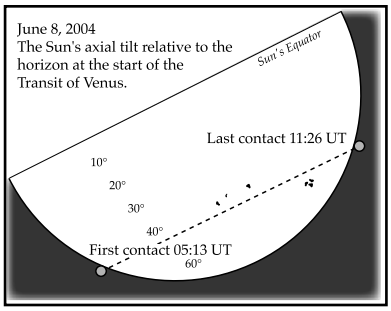

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According to Babbage's definition, Mendel would have been an accomplished cook (*2*). Hoaxes are jokes usually played on "scientific academies, which have reached the period of dotage" (*1*). The goal of a hoax is the ridicule placed on those who credit it before it is disclosed. Finally, forging is the fabrication of fictitious results according to one's expectations, with the goals of gaining a reputation and never disclosing the forgery.

Babbage's growling account of Victorian science suggests that misconduct is a venerable phenomenon starting with Newton (*3*), rather than a young nuisance starting with Millikan (*4*). The roots of fraud should therefore be sought in basic tenets of science, rather than in modern funding or publishing policies (*5*). Here, I propose that misunderstanding the predictive power of science as a sort of guarantee to be right may be the primary motive for forgery.

The literature on scientific misconduct tells some of the most amusing, thrilling, distressing, maddening, and appalling stories of science [e.g., (*5*–*8*)]. All those who have written on scientific misconduct seem to agree that forgers usually do not want to falsify their research, but to cut corners in reaching a conclusion that they genuinely believe to be true [e.g., (*5*, *9*)]. This common theme among those who have studied the phenomenon of scientific misconduct, however, begs the question: How can forgers genuinely believe in the truth of their falsifications? Understanding the primary motives of perpetrators is the key to preventing scientific misconduct before it happens, which has been announced as a major goal by British and German science organizations (*10*).

Like men and women of genius, forgers often mistake their personal ideas, including their idiosyncrasies and subtle misunderstandings, as being exactly identical to abstracted scientific theories, and believe in their predictive power. Alas, technical journals, their editors, and reviewers obstinately insist on some kind of substantiation of any new idea, preferably experimental evidence. Why should the forgers go to the length of conducting the required experiments, when they can predict the outcome in advance, because they already know the proper theories?

Hence, forgery would be a homemade problem of scientists mistaking the predictive power of abstract things called science, or theory, with the predictive power of personal knowledge, or ideas. While the former might be considerable, the latter will always be very limited. The first step toward preventing more forgery should therefore lie in teaching a scepticism that suspects personal fallibility and self-deception rather than deconstructing tenets like the predictive power and objectivity (*11*).

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CORRECTIONS AND CLARIFICATIONS

News Focus: "A healthful dab of radiation?" by J. Kaiser (17 Oct., p. 378). Sheldon Wolff did not win a Nobel prize. Also, a recent analysis challenges earlier claims that atomic bomb survivors exposed to low radiation doses are living longer than controls: www.rerf.or.jp/eigo/update/spring2002.pdf.

TECHNICAL COMMENT ABSTRACTS

COMMENT ON "Salt-Pump Mechanism for Contaminant Intrusion into Coastal Aquifers"

D. R. Lloyd

Dror *et al.* (Brevia, 9 May 2003, p. 950) claimed a dramatic effect for diffusion of contaminants out of salt water. However, the results reported cannot be due to simple diffusion, and the proposed activity-driven mechanism is not consistent with the observations. This casts doubt on the suggested contaminant intrusion. Possible explanations of the observations are suggested.

Full text at www.sciencemag.org/cgi/content/full/302/5646/784b

RESPONSE TO COMMENT ON "Salt-Pump Mechanism for Contaminant Intrusion into Coastal Aquifers"

Ishai Dror, Bruno Yaron, Brian Berkowitz

Our study demonstrated high organic compound (OC) concentrations in saltwater and significantly enhanced transport to freshwater. Transport of OCs is not a purely molecular diffusive process. Contrary to the Comment by Lloyd, we argue that the "salt pump mechanism" is also clearly influenced by saltwater-freshwater density differences. New supporting experimental results are presented.

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