Letters

Bacillus thuringiensis and Pest Control

The Pollyanna-like view of *Bacillus thuringiensis* (Bt) transgenic plants controlling pests reflected in the Research News article by Anne Simon Moffat (12 April, p. 211) belies past experience and present evidence. Chlorinated hydrocarbons, carbamates, organophosphates, pyrethroids, and other classes of chemicals have all been touted as panaceas for pest control. They were shortly found to be inadequate in most prophylactic applications because some individuals in the treated pest population had the genetic predisposition to be able to survive the treatment and the capacity to pass this capability on to their progeny. Transgenic Bt endotoxins will suffer the same fate if they are used to protect plant populations over wide areas. This and related genetic engineering technologies that rely on confrontational prophylactic tactics pose a significant threat to the stability of production agriculture for several reasons.

First, resistance is inevitable. The continued effectiveness of the fermented Bt toxins over the past four decades has been primarily due to the limited applications made and the short residual activity they had after application. The surviving target pest population and other organisms in and around the treated area simply escaped the toxin, which primarily affects feeding lepidopterous larvae (more recently toxins effective against dipteran and coleopterous larvae have been developed), leaving susceptible adults, eggs, and pupae to survive and reproduce with the few, if any, larval survivors of the treatment. Incorporation of the Bt toxin in the tissues of tomatoes, cotton, corn, and other crops so that it is expressed from seedling to harvest and protected from ultraviolet degradation and weathering will largely eliminate escape and concentrate survivors in the crop. The rate at which resistance will develop into an economic problem depends mainly on the intensity of exposure. This is related to the crops incorporating the technology and the area over which they are used. If Bt toxins are simultaneously deployed against *Helicoverpes* in cotton, corn, and sorghum, I predict perhaps 25 to 75 generations (3 to 9 years) will elapse before resistance renders the technology useless.

Second, resistance developed in response to transgenic Bt will transfer to fermented Bt products and render them useless against resistant pests. Third, currently effective conventional pesticides will perhaps be discontinued (because of decisions not to reregister, loss of market share, and other factors) and thus be unavailable in 3 to 9 years to prevent the epidemics of resistant pests that will ensue. Fourth, new or alternative technologies will not be on-line because the Bt transgenic plants will stifle competition.

This impending disaster is preventable by more judicious deployment in time and space or by engineering the Bt transgenic plants to express the toxin in just the susceptible tissues during the brief periods they are vulnerable to attack. This would suffice to prevent damage to the resource valued by humans and would allow the majority of the Bt-susceptible pest population to escape and breed with the few that are resistant.

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Response: While Harris may be correct that Bt transgenic plants will create problems "if delivered as an omnipresent component to protect plant populations over wide areas," Moffat's article makes it clear that transgenic plant production is but one of several biological pest control strategies moving through the R&D pipeline. Indeed the article's point was that such biocontrols are now receiving serious consideration from mainstream farmers and industry, as well as from academic scientists—a development that should be cause for optimism.—EDS.

Name of the Game?

Albert Szent-Georgyi once separated scientists into Apollonians and Dionisians (*1*). Such categories can rapidly become frivolous (for example, men and women or young and old), but Marcia Barinaga, in her article "Labstyles of the famous and well funded" (News & Comment, 28 June, p. 1776), might have separated the entrepreneurs from the artisans or the meretricious from the penurious.

The point is, and it is an important one, that it is the organization of laboratories that has resulted in most of the tedious scandals of recent years. An entrepreneur becomes dissociated from the bench and is unable to evaluate the work he or she uses in raising capital. We all know such executives who have "coauthored" hundreds of papers without ever having put vials in a scintillation counter, run a gel, or experienced the agony of all the controls coming up positive. The predictable scandals occurring in science today are not moral issues, but result from organizational failure—from executives being victimized by the obscure member of a laboratory who fudges results to seek the same eminence and approbation as the "famous and well funded." Sadly, it's the name of the game.

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Supersymmetry

We are concerned about whether the readers of David Hamilton's article "A tentative vote for supersymmetry" (19 July, Research News, p. 272) have been left with an incorrect impression of the meaning and conclusions of our recent paper (*1*).

With respect to the range of supersymmetry (SUSY) masses we derived from our fits, the average value of the masses of the SUSY particles (M_{SUSY}) is given as $10^{3\pm1}$ gigaelectronvolts (GeV), where the error of ±1 in the exponent corresponds to one standard deviation. This implies that the probability that the average SUSY mass lies within the interval 10^2 to 10^4 GeV [that is from 100 GeV to 10 teraelectronvolts (TeV)] is roughly 68%. The article is therefore misleading when it says, "Amaldi and his colleagues were able to limit the masses of the superparticles required for unification to an especially narrow range—between 100 GeV and 2 TeV." Indeed, the 68% range is 100 GeV to 10 TeV, and the 95% confidence level range, obtained by doubling the error, is 10 GeV to 100 TeV. Because the data do not allow a more precise determination of M_{SUSY} than this order-of-magnitude estimate, there is at present no point in performing very sophisticated fits with even more parameters, as some theorists have suggested.

Second, Hamilton writes, "a new series of measurements at CERN has again set some physicists talking about 'evidence' for supersymmetry." As far as we are concerned, we did not write of "evidence for SUSY." The introduction of our paper states, "The precision of the LEP [Large Electron Positron Collider] data allows [us] to extrapolate the three coupling constants of the standard model (SM) to high energies with small errors, thus allowing [us] to perform *consistency checks* of grand unified theories" (emphasis ours). The point is reiterated in our conclusions: "The combination of precise data on the electro weak and strong coupling constants measured at LEP with the limits on the proton lifetime allows stringent *consistency checks* of unified models" (emphasis ours). Thus, there is no "evidence," only "consistency checks."

Finally, we did not conclude as others may have done that "these spectacular re-

sults imply that it will be possible to find supersymmetric particles at the Superconducting Super Collider (SSC)." We wrote, "if this minimal supersymmetric GUT [grand unified theory] describes Nature, SUSY particles, which are expected to have masses of the order of M_{SUSY}, could be [not "will be"] within reach of the present or next generation of accelerators." The reason for our caution is that the next generation of hadron colliders [the Large Hadron Collider (LHC) and the SSC] will reach SUSY masses of a few TeV and not even 10 TeV. In our mind the relevance of the results of our fit (which is, to our knowledge, the first one performed) is not a precise value of M_{SUSY}, but rather the conclusion that the simplest SUSY model provides an amazingly and puzzlingly consistent picture for the unification of the strong and electroweak forces. In agreement with theoretical arguments, M_{SUSY} turns out to be more than 10^{11} times smaller than the unification energy, while the latter is consistent with the present limits on the proton lifetime.

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More Than One Star

Faye Flam's Research News article "Seeing stars in a handful of dust" (26 July, p. 380) was generally accurate. However, it did not give credit to my co-workers Roy S. Lewis, Sachiko Amari, Gary Huss, and Tang Ming, who did the actual isolation and identification of interstellar grains. I only provided general planning and advice and wrote most of the papers.

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