Letters

Planet Exploration

Barret Rock is quoted in William Booth's article "Monitoring the fate of the forests from space" (News & Comment, 17 Mar., p. 1428) as being in favor of "using our space program to look down rather than look up." "Mission to Planet Earth," as the government program for Earth observations is being called, obviously should be supported by the U.S. space program, but there is no necessity to make it an alternative to the proposed American-Soviet human exploration of Mars, as does Rock. They are two different things. One is a relatively inexpensive, robotic series of space observations, responding to an urgent global problem. The second is a proposal to involve the high technology and creative development of the industry and science of the superpowers in response to an evocative human calling: exploration of other worlds. Comparing the two programs is not valid—politically, economically, or technically.

We can turn our attention from space to Earth, as is suggested. But a policy of looking inward is hardly a rejuvenation of peaceful civilian space exploration, nor is it an optimistic expression about the role of the United States in the 21st century. The Planetary Society is urging the goal of human Mars exploration and is also advocating international cooperation in "Mission to Planet Earth." There is great synergy among these goals. After all, it was American exploration of the planets that taught us about the greenhouse effect and much about ozone depletion.

Let us move forward to protect this planet and to explore others.

LOUIS FRIEDMAN
The Planetary Society,
65 North California Avenue,
Pasadena, CA 91106

Science Education

Daniel E. Koshland, Jr. (Editorial, 24 Feb., p. 989), says that part of the problem with science education in the United States is a lack of imagination on the part of teachers. To the contrary, given teachers' low prestige, meager salaries, lack of funds for resource materials, and burden of overcrowded classes, it is a tribute to their imagination that they are able to teach even the minimum of science and mathematics.

If there is any lack of imagination, it is on the part of those government officials responsible for solving funding issues in education. One solution, as Koshland points out, is to emphasize excellent science and math education at the primary school level. While such a focus is needed, it is an interim solution that mainly addresses the problem of allocation of existing funds. Yet, we need to start at an even more basic level than that. What is required to provide excellent education (including science) in this country is a fundamental change in attitude on the part of the citizenry and of state and federal governments. We must eliminate the attitude that schools are holding tanks for children and that the welfare of children is solely a parental issue. Instead, we need to establish a sincere regard for children as a public resource on which the future viability and vitality of this nation, and our own welfare, depends. By extension, the schools, as agents in ensuring that the nation benefits from, rather than wastes, that resource, should be supported accordingly.

As Koshland also points out, there is a moral charge to give each child an equal opportunity to acquire a good education (and one might argue that it is a right). But, considered in practical terms, arguments for fairness or rights alone will not result in increased political and fiscal support for education. Rather, what will result in support is establishing that it is to our economic advantage to provide generously for well-educated, productive members of society and that it is economically disastrous to allow for poorly educated, nonproductive individuals. It must be understood by all that there is no investment that provides a greater return than a well-educated generation of children.

GRANT M. CARROW
Graduate Department of Biochemistry,
Brandeis University,
Waltham, MA 02254-9110

Alar and Apples

Leslie Roberts (News & Comment, 10 Mar., p. 1280) calls Alar, used to ripen apples, a "pesticide." Alar (daminozide) is a plant growth regulator, not a pesticide (*1*). Alar breaks down to UDMH (unsymmetrical dimethylhydrazine), exposure to which, says Roberts, "according to NRDC [Natural Resources Defense Council] calculations . . . poses a cancer risk of 1:4200"; but Roberts does not state the level of exposure to UDMH or Alar (or anything), although L. Mott of NRDC was quoted by E. Hersher of the San Francisco *Chronicle* (*2*) as saying that the Environmental Protection Agency's tolerance level of Alar in apples could make thousands of children sick.

Levels of UDMH were evaluated by Sagelsdorff *et al.* (*3*), who comment that, in a test by B. Toth *et al.*, the high toxicity of UDMH for mice makes it difficult to evaluate the studies. Druckrey *et al.*, cited in (*3*), found UDMH was a very "weak liver carcinogen" for rats; according to Sagelsdorff *et al.* (*3*), it was "at least two orders of magnitude less potent than dimethylnitrosamine." They estimate that 120 micrograms of daminozide and 2.4 micrograms of UDMH are present in a daily portion of one "300-gram Alar-treated apple." Surely more information is needed before one can evaluate the quantitative risk from UDMH.

Other hydrazines, some of which are present in edible mushrooms, are carcinogenic in test animals (*4*). Ames *et al.* (*5*) rank one 15-gram raw mushroom (*Agaricus bispora*) as equivalent in hazard to 0.21 microgram of aflatoxin, as present in three peanut butter sandwiches.

Roberts quotes the NRDC on the dangers of "carcinogenic fungicides" "typically used in apples and other fruits." "Organic" apple juice, recommended by NRDC, may contain up to 45 parts per million of patulin, a suspected carcinogen (*6*) produced by *Penicillium expansum* and other molds on apples. It is hoped that "noncarcinogenic" fungicides can be used on nonorganic apples to stop mold growth.

THOMAS H. JUKES
University of California, Berkeley,
6701 San Pablo Avenue,
Oakland, CA 94608

REFERENCES AND NOTES

1. The Environmental Protection Agency applies the term "pesticide" (Roberts used the word 29 times), apparently for bureaucratic convenience for nonpesticides including bacteria that induce frost resistance. Alar got blamed for being a pesticide and pesticides got blamed for being like Alar.
2. E. Hersher, San Francisco *Chronicle*, 18 March 1989, p. A16.
3. P. Sagelsdorff, W. K. Lutz, C. Schlatter, *Fund. Appl. Toxicol.* **11**, 723 (1988).
4. E. C. Miller and J. A. Miller, *Biochemistry of Nutrition* (University Park Press, Baltimore, MD, 1979), pp. 123–165.
5. B. N. Ames, R. Magaw, L. S. Gold, *Science* **236**, 271 (1987).
6. D. M. Wilson, in *Mycotoxins and Other Related Food Problems*, J. V. Rodricks, Ed. (American Chemical Society, Washington, DC, 1976), pp. 90–109.

Response: It is common practice to refer to agricultural chemicals, like the growth regulator Alar, as pesticides. The Environmental Protection Agency deals with Alar and a wide range of other agricultural chemicals generically as pesticides. So does the National Academy of Sciences.

—LESLIE ROBERTS