Letters

More on Chemical Carcinogenesis

Miriam Meisler and Ernest E. McConnell (Letters, 16 Oct., p. 259) are critical of Philip H. Abelson's editorial "Cancer phobia" (31 July, p. 473). Abelson discusses shortcomings of the animal tests used by regulatory agencies to gauge human susceptibilities to carcinogenic chemicals. Both Meisler and McConnell favor continued use of the present procedures. However, in their critiques they disregard the basic reasons for Abelson's reservations about animal tests. As he points out, many major substances have erroneously been labeled as carcinogens because of questionable evidence provided by animal tests. In support of this allegation he refers to the fact that "there has been no overall increase in cancer," provided cancer-mortality data are adjusted to eliminate the effects of cigarette smoking.

This all-important observation deserves some amplification. A decade ago, John Cairns (*1*) stated:

> In fact, with the exception of lung cancer, all common cancers have been common since the 19th century. For example, in the United States, there has been little change in the incidence and death rate from cancer as a whole in the last 30 years during which time the annual production of pesticides, synthetic rubber and plastics has risen more than 100-fold.

This statement was more accurately defined by John C. Bailar III and Elaine M. Smith (*2*). Using age-adjusted mortality rates and excluding lung cancer, cancer of the stomach, and cancer of the cervix, these authors determined shifts in overall cancer mortality from 130.1 in 1950 to 128.9 in 1982, a change of less than 1% in three decades.

On the basis of these data, there cannot be any doubt that the ever-increasing production of new and old industrial chemicals—many of which have been labeled "hazardous" by rodent tests—has not resulted in an increase of cancer mortality. Nor has an increase occurred but remained confined to the work force at chemical plants, a situation that would have been just as unacceptable as an increase for the whole population. The Dow Chemical Company, a past producer of Agent Orange, reported recently (*3*) that the health of all employees at its Midland and Bay City plants had been monitored between 1940 and 1982. A survey of the data has established that these employees have not experienced statistically significant higher rates of death from any cause, including all cancers.

With the realization that the increasing production of industrial chemicals has not brought about a rise in cancer mortality, there can no longer be confidence in the teachings of rodent cancer tests. Abelson's editorial is a document of sound scientific judgment.

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2. J. C. Bailar III and E. M. Smith, *N. Engl. J. Med.* **314**, 1226 (1986).
3. *Chem. Eng. News* **65**, 7 (14 September 1987).

. . .Abelson is correct in regretting that so much effort has gone into routine bioassays of little or no value ("counting lumps and bumps") when we could well be much further ahead had the same resources been devoted to fundamental research on mechanisms of carcinogenesis. The real problem is not one of rating carcinogens by potency with the use of data from high-dose, long-term animal feeding tests. The unresolved critical issue, to which far more thought and effort must go, is determining the relevance of such results to human circumstances.

It is doubtful, for example, that public health has been advanced by the results of the National Toxicology Program's bioassay which found that, under the conditions of the tests, allyl isothiocyanate was carcinogenic in male rats, equivocally carcinogenic in female rats, and noncarcinogenic in mice (*1*). Those results have been widely—and wisely—ignored.

No one has yet suggested that, because broccoli, cauliflower, cabbage, and mustard contain allyl isothiocyanate, we should forego them. Instead, our National Cancer Institute urges us to eat more of them in the hope of decreasing the risk of cancer.

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Agricultural R&D

In considering Don Holt's proposal for agricultural research and development (Policy Forum, 18 Sept., p. 1401), it is useful to remember that for most of its history the U.S. Department of Agriculture (USDA) supported projects designed to promote both short- and long-term farm productivity. It was only recently that USDA, prompted by the National Academy of Sciences, shifted the emphasis of some of its programs toward basic research. The purpose of this shift was to provide basic biochemical information to promote the development of new products by private enterprise and to provide necessary information needed for rational programs in molecular biology. Many large commercial research organizations specifically asked the USDA to provide this type of support.

Holt is now proposing relatively large expenditures for support to farmers on site with situation-specific information. The USDA already provides such support through its extension service. Although it would be unfair to say categorically that increased funding for such programs would provide no benefit, it is fair to ask if increased funding would provide maximum benefit to the United States, especially when one considers the likely possibility that a portion of the funding will come at the expense of basic research.

Holt states that the U.S. share of the world market for certain commodities has declined from 60% to 40%, and he predicts ominous consequences for U.S. farmers if declines continue. However, this share decrease is due to increased world production, not to decreased U.S. production. Given large increases in world population, we should give thanks that world production is up, rather than complaining about it. While the last few years have not been the best for U.S. farmers, it will come as a pleasant surprise to some that this year overall farm income (inflation-adjusted) will be back to its average (computed since 1959) (*1*). This recovery has as its basis the decline in the U.S. dollar and a more sensible government farm policy. It has nothing to do with any particular breakthrough in agricultural technology. By the same token it is unfair to say that existing agricultural research programs are ineffective or were in any way responsible for the recent difficulties that beset our farm industry. If farm income is now back up to its average, is a new expensive program really needed?

Holt states that his proposed programs would ultimately reduce production costs and thereby increase our competitiveness worldwide. Regrettably most of the barriers to increased U.S. farm exports are not economic, but political. Those countries that have the most money to buy our products have in place strong import barriers designed to protect their own domestic agriculture. Any progress that is made in reduc-

ing our own production costs may be offset by an increase in these barriers. This is why an analysis of "private firms operating in extremely competitive industries" is not very useful for understanding global agricultural competitiveness.

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1. H. Banks, *Forbes* (19 October 1987), p. 27.

Holt describes an R&D strategy to make U.S. agriculture more competitive. I agree with him that U.S. agriculture needs "much stronger programs of on-site and situation-specific agricultural research" and that with production-related research "all other agricultural research activities come to fruition." I take issue, however, with some of his other implications.

Holt states that "site- and situation-specific research and extension programs benefit producers in other nations relatively little." This assumes that other areas of the world do not have soil and climactic conditions similar to those found in the United States. He also states that "The United States should create a superior delivery system for its agricultural production technology and farm management information, so that information is used earliest and most effectively by U.S. farmers." Both of these statements imply that the United States is isolated from the rest of the world or, more dangerously, that the United States should endeavor to become isolated.

Holt makes a clear distinction between "basic" and "production-related" research. He goes so far as to state that "adaptive research has little glamour, especially compared to such fields as biotechnology." The distinction between basic and applied research is arbitrary and depends on one's perspective. In addition, all agricultural research should be "production-related." No research, at least for the majority of scientists, is glamourous, unless one considers the satisfaction of doing quality research glamorous. Holt goes on to argue for a substantial increase [$2.8 billion per year; approximately one-half the total funding for the National Institutes of Health in 1987 (*1*)] in federal and state funds for "adaptive agricultural research and related extension programs." Rather than argue the merits of "basic" versus "applied" research, perhaps agricultural researchers should take a lesson from medical research, in which both basic and applied (clinical) studies are vitally important, one depending on the quality of the other.

Quality of research is, to me, the heart of the matter. In considering a competitive strategy for agricultural research, the United States should emphasize quality in both basic and applied research, rather than emphasizing one type of research over another. To accomplish this, a portion of funds for agricultural research should be awarded on a competitive basis. The U.S. Department of Agriculture has already taken a step in this direction by expanding its Competitive Research Grants Program. Such programs need to be further expanded and include funding for both basic and applied research to ensure that U.S. agriculture will remain competitive in a global market.

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Holt's comments on the need for a "Competitive R&D strategy for U.S. agriculture" should be of concern to all public administrators involved in the establishment of funding priorities for research in agriculture.

Oversight committees and panels have criticized agriculture for conducting too much "site-specific" research, for inadequate emphasis on basic research, and for poor coordination among disciplines and commodity-oriented research programs, or both. Some but not all of this criticism has been justified. Conversely, basic research has had a significant role in agricultural research; and few would deny the opportunities that could be exploited through advances in biotechnology.

One cannot help but ask, however, if in our haste to meet the challenge of the future, we have overlooked the primary mission of agricultural research? The answer seems apparent when one encounters agricultural research locations where 20 to 30 scientists are working on various aspects of plant biotechnology, but where not a single agronomist is available to devote his or her efforts to the efficiency of agricultural production systems.

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Response: Basic research is essential, as pointed out by Piazza, Reynolds, and Hanson, and holds great potential for eventually improving the quantity, quality, and affordability of agricultural products. Both agricultural and nonagricultural institutions and agencies should be involved in this important activity. Basic research alone will not, however, provide U.S. farmers a competitive edge in international agricultural markets, for reasons explained in my Policy Forum.

Achieving competitive advantage is important. The United States can probably afford to buy its agricultural products from other nations, but it needs the economic activity generated by its agriculture, including production agriculture and the infrastructure it supports. Also, to conserve the world's natural resources, crop commodities should be produced on naturally productive land that is least susceptible to soil erosion and that receives ample natural rainfall. The United States possesses larger areas of such land than most of its competitors. Other things being equal, farmers producing on such land should compete well.

Piazza suggests the "USDA extension service" provides the essential site- and situation-specific information for farmers. The Cooperative Extension Service, largely supported by states and counties, relies heavily on State Agricultural Experiment Stations and the Department of Agriculture's Agricultural Research Service for the information it disseminates, which is generated by adaptive research. The extension service has many other clients besides farmers and faces many new demands, including helping rural municipalities develop economically, retraining displaced farmers, and addressing a host of agriculture-related urban concerns.

Many programs in the extension service have been cut substantially in the last 3 years (with a 17% staff cut in Illinois) because of dwindling federal support and increasing costs. The extension service cannot be expected to provide high-tech decision support for production agriculture, as Piazza suggests, without additional resources.

The U.S. loss of a share of the grain market is a real loss, not a percentage loss, as Piazza contends. U.S. exports of wheat, coarse grains (including corn), and soybeans decreased 50 million metric tons (20%) between 1984 and 1986 (*1*, p. 10). Piazza's "pleasant surprise" that overall farm income will be back to its long-run average is much less pleasant when one realizes that 40% of farmers' net cash income is being provided by subsidies in the mid-1980s, compared with about 3% in the mid-1970s (*1*, p. 15). Farmers' average debt-asset ratio increased about 50% in the same period (*2*).

Piazza worries that reduced production costs achieved by vigorous adaptive research and technology transfer programs would be offset by competitors' protectionist trade policies. A nation can keep exports out by