

receiving the bovine growth hormone. Rifkin then appeared on national network television with scare stories about the dangers of milk from cows receiving bGH. He cited as evidence baseless assertions from a report prepared by Dr. Samuel S. Epstein, from Chicago. Typical was the claim that bovine somatotropin could potentially be absorbed from milk into the bloodstream, particularly in infants, and produce "hormonal and allergic effects."

Five major supermarket chains then announced they would not handle dairy products from milk from bGH herds. Also, Ben and Jerry's Homemade Ice Cream—whose "un-adulterated" product caters to the "thirtysomething" crowd's cravings for designer foods, announced they would not only shun bGH-connected milk, but they would carry an ad on their ice cream cartons, proclaiming "Save Family Farms!"

The timing of this Rifkin anti-bGH campaign before schools opened was key. There is a national and international shortage of milk, which became very visible when schools opened in September. Rifkin's campaign for "pure milk" was designed to divert attention from the fact that depleted herds need to be built up, dairymen and other farmers need emergency assistance, and growing, healthy children need milk.

The U.S. Department of Agriculture, as of this fall, has cut off the distribution of all federal stocks of cheese to school lunch programs. For the first time since 1974, there is none to give out. The USDA has discontinued supplying dried milk powder to the WIC—Women, Infants and Children—program. There is none to give out. Local dairy-processing plants are scrambling to get enough raw milk for fresh, fluid milk supplies for schools. In one instance, at Johanna Farms in New Jersey, milk was brought by tank truck from Washington State, a practice which guarantees that milk arrives "stale," no matter how carefully it is handled.

In May, House Agriculture Committee Chairman Kika de la Garza (D-Tex.) released a statement saying, "The Deputy Secretary of Agriculture Jack Parnall has confirmed that due to reduced surplus production of dairy goods there will be far less milk and other dairy products to distribute to school districts for use in lunch programs across the nation." De la Garza pledged "Our continuing support of the school lunch program as a way of ensuring that youngsters receive proper nutrition during their early school years." The result of the pledge? Nothing. An estimated 12 million children from low income families are potentially suffering the loss of this high-protein food.

What is Jeremy Rifkin?

Rifkin has specialized over the years in attacking technological advances, not just in agriculture, but also in defense and in energy production. Last spring, he lashed out against the threat of limitless energy from "cold fusion," because it would raise living standards and cause

population growth. He uses specious arguments and plays on irrational fears and bogeymen: "If you interfere in Mother Nature, who knows where it may end?" Rifkin is one element in a grouping of anti-technology fanatics who are committed to drastic population reduction and want no advances in food production to derail their agenda. For example, a cohort of Rifkin's, Daniel S. Greenberg, who works out of Washington, D.C., wrote against the use of bGH in the *Sacramento Bee*, "In the perverse uses of science, it would be difficult to surpass the creation of a man-made hormone that induces cows to produce more milk, a commodity whose surpluses fill storage caves and drain treasuries in the United States and many European nations." The latter claim that there is overproduction is a straight lie. However, Greenberg makes his real point by asking, "A relevant question, of course, is who needs more milk, even if it's a bit cheaper?"

The facts on bovine growth hormone

by Thomas H. Jukes

Dr. Thomas H. Jukes is a professor-in-residence in biophysics and nutritional sciences at the University of California at Berkeley. An earlier contribution refuting the cancer scare around the growth regulator alar in apples, "Consumers Union publishes bad science on good apples," appeared in our May 15, 1989 issue.

Recent allegations by Samuel Epstein about purported dangers of administering bovine growth hormones (bGH) to dairy cattle^{1,2} have been adequately rebutted by the Food and Drug Administration (FDA)^{3,4,5}. There are some obvious biochemical facts that Epstein has not mentioned, in addition to those listed by the FDA.

First, the ingestion of "foreign" proteins (proteins of non-human origin) is implied by Epstein to be generically dangerous² because of differences in amino acid sequences. But the main proteins of cow's milk are casein and lactalbumin, both of which are different in their amino acid sequences from the corresponding patterns in humans!

The amino acid sequences of bovine and human lactalbumin differ by about 23%⁶. Bovine and sheep kappa caseins differ by 19%. Human and bovine kappa caseins differ even more widely^{6,7} because of their greater evolutionary divergence, as shown by the "molecular evolution-

ary clock." Yet these "foreign proteins," which are present in bovine fluid milk at levels of about 1% and 2.5% are among the most important and best-tolerated proteins in the human food supply, and the amounts ingested are greater by several orders of magnitude than any possible traces of bGH in milk. Since bGH is produced naturally by cows, most of the allegations made by Epstein apply also to market milk from untreated cows, and the allegations have no scientific basis.

Second, the "alien methionyl terminal residue" in bGH is viewed with alarm by Epstein. *All* proteins start with a methionine terminal residue, and this is normally removed by a special enzyme during protein synthesis⁸. So there is nothing to make us feel xenophobic about a terminal methionyl residue.

My next point is a reminder that genetic selection of cattle for high milk production, as practiced for many years, was, in effect, selecting cattle that secreted higher levels of bGH. This is how the Holstein-Friesian breed (now known as Holsteins) came into being, in contrast with beef cattle, such as Herefords, with low milk production. The use of bGH is an acceleration of this familiar genetic practice, rather than a strange innovation calculated by Epstein to arouse "America's new timorousness" that contrasts so abruptly with this nation's adventurous spirit prior to the 1960s.⁹

The cancer argument, revisited

Fourth, Epstein deplores the negative energy balance induced by "biosynthetic milk hormones," but he simultaneously notes that this normally occurs in the rising phase of lactation. This is well known in dairy husbandry. The Holstein breed, in particular, normally draws on body reserves, including bone calcium, during lactation. Epstein views this negative energy balance with horror and he claims that this normal biorhythm will, when (allegedly) prolonged by bGH, be "associated with increased stress, susceptibility to infectious disease and measurable changes in the composition of milk." Also, Epstein² claims that "the fat and milk of cattle are contaminated with a wide range of carcinogens including pesticides such as heptachlor epoxide and dieldrin, and xenobiotics such as PCBs and tetrachlordibenzo dioxin" and that such contaminants are "likely" to be increased by bGH. But on page 8 in the same treatise he says that no information is available on these "concerns." This approach seems like scare-mongering, but let us examine the allegations further.

(a) If "the fat and milk of cattle are contaminated with a wide range of carcinogens" then milk would not be fit to drink.

(b) The pesticides and "xenobiotics" listed above are not known to be human carcinogens. The pesticides he names have been banned, and therefore are not used. The only carcinogenic responses to them have been in special strains of mice and rats. Animal studies with PCBs (the content of

which in milk is set at a maximum of 1.5 parts per million in milk fat by the FDA) "do not provide convincing evidence that PCBs induce liver cancer,"¹⁰ and studies by the Michigan Department of Public Health showed no health effect in humans. Dioxin is a potent animal carcinogen, but the only effect found in humans exposed to high levels of dioxin is a skin rash, "chloracne."¹¹ In any case, there is no evidence that the levels of these four substances in milk are likely to be increased by bGH.

The amounts of pesticides encountered in foods, including milk, are so small that they are insignificant in comparison with naturally occurring toxicants, as explained at length in various publications by B.N. Ames et al. (for example, *Science* 236, 271: 1987). Is Epstein attempting by tortuous arguments, to play on the public fear of pesticides as a device to arouse suspicions of bGH. If so, the target of his arguments is milk, not bGH.

Fifth, Epstein alleges that bGH will increase the level of infectious disease in cattle, so that antibiotics will be used for treatment, so that there will be "increased" levels of antibiotics in milk, so that antibiotic resistance will be induced "in the general population." The use of antibiotics in dairy cattle is in penicillin treatment of mastitis. This use is followed by a withdrawal period, only because a few people are allergically sensitive to penicillin, not because "antibiotic resistance will be induced in the general population." So, this imagined "domino effect" of an imagined train of events is something that won't happen!

Rather than dilate upon the other pessimistic forebodings listed by Epstein, a general comment is in order: If bGH is as bad as he claims, it will never get off the ground, because it will never be successful enough to reach the market place at all.

An innovation in the food supply should by all means be thoroughly examined and criticized before being introduced. But Epstein's exaggerations and fantasies do not contribute usefully to such an examination.

Notes

1. Epstein, S., July 27, 1989, "Growth Hormones Would Endanger Milk," *Los Angeles Times*.
2. Epstein, S., "Potential Public Health Hazards of Biosynthetic Milk Hormones", MS sent to FDA Commissioner F.E. Young, July 19, 1989.
3. Guest, G.B., letter to *Los Angeles Times*, Aug. 1, 1989.
4. Aikman, B., Talk Paper, FDA T89-50, August 4, 1989.
5. Cannon, H.C., FDA, letter to Congressman Peter Smith, Aug. 4, 1989.
6. Dayhoff, M., *Atlas of Protein Sequence and Structure*, 1972 and 1978.
7. Brignon, G. et al., FEBS letters 188 48 (1985).
8. Watson, J.D. et al., *Molecular Biology of the Gene*, third edition, 1987, p. 411.
9. Fairlie, H., "America's Fear of Living," *The New Republic* 1989, reprinted in the *Sacramento Bee*, Forum, p. 1, April 23, 1989.
10. Report by Drill, Friess, Hays, Loomis and Shafter Inc., cited by EPA in report on PCBs, Sept. 1, 1983.
11. *Science* editorial, June 24, 1983.