

Why Not Have More Milk?

In the past, biological products derived from the human had to be extracted or isolated from bulk materials, but now, with genetic engineering, gross amounts can be prepared by placing the appropriate gene in the genome of a friendly bacterium. Genetic engineering is a major scientific advance of our time and has made major contributions to medicine. Prominent products of this exciting biological advance are insulin, growth hormone, and interferon.

The principle of genetic engineering is simple. A foreign gene is inserted into the genome of a bacterium, and the bacterium uses the gene as a template for the synthesis of the cognate protein. The product derived from the implanted gene is identical to that which would have been produced in the organism from which it was derived. For example, human insulin produced by such a bacterium is truly human in its action and in its immunologic reactions. Similarly, genetically engineered bovine somatotropin (rbSTP), also known as bovine growth hormone (rbGH), is physiologically identical to naturally occurring bovine somatotropin (bSTP).

But rbSTP has created such a massive flurry of health concerns and political and commercial attention, both pro and con, that two states have considered legislation that could seriously affect the use of the hormone; the Food and Drug Administration has been under considerable pressure and has taken unprecedented action and disclosed the results of some studies before the release of rbSTP for general consumption; and under congressional persuasion, the National Institutes of Health recently conducted an in-depth technology assessment conference.¹

Although the four companies involved in the manufacture of rbSTP have conducted almost a decade of extensive research and found rbSTP to be safe, a number of arguments have arisen concerning the use of the hormone.² Discussion has come from groups as divergent as the well-known opponents of biotechnology (*Time*, December 4, 1989:102, 104) and dairy farmers. Some believe that genetic engineering is dangerous and should be shelved for the time-being. Others believe that the use of rbSTP is dangerous to the cow, that it will cause an increase in inflammatory disease of the mammary gland, and that the growth-promoting

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activity of the hormone will cause wasting of the animal. Still others clamor that the hormone will contaminate milk and thereby will have a detrimental effect on human physiology. Finally some are concerned about the effect of rbSTP on the commercial aspects of dairy farming.³

To the pediatrician, however, rbSTP is valuable. It can increase a cow's production of milk by 10% to 25%, thereby making this important food available to more people. Milk from cows treated with rbSTP is safe for infants and adults. Milks ordinarily contain small quantities of protein-hormones, but they are destroyed almost completely either in the gut or during pasteurization. In addition, rbSTP is not active in the human because it cannot bind to human receptors. Maintenance of lactation in the cow requires only bSTP; in contrast, lactation in the human requires both STP and prolactin. The difference in the sequence of amino acids between somatotropin (human) and bSTP (bovine) changes the tertiary structure of the protein and thus the receptor-binding properties of the bSTP.⁴

Although bSTP has no detectable receptors in the mammary gland of the cow, it stimulates the production of insulin-like growth factor; however, this protein-hormone that does have receptors in the mammary gland appears only in negligible quantities in milk. In the manufacture of formula, an additional heating process destroys any residual hormone.

The paper published by Juskevich and Guyer of the Food and Drug Administration⁵ should have put to rest the idea that milk or meat derived from animals treated with rbSTP is unsafe for humans. They made the following statements "... bGH is biologically inactive in humans, rbGH is orally inactive, and rbGH and bGH are biologically indistinguishable. . . . Thus, rbGH treatment appears to have no significant impact on the nutritional quality of milk."⁵

Production of milk by the cow injected with rbSTP is increased, and there is a concomitant increase in the nutritional needs associated with the increased lactation. Mastitis is usually more common in those cows that are high producers of milk. But the evidence presented at National Institutes of Health conference¹ indicates that (a) the frequency of mastitis in treated cows is no higher than that in cows that are naturally high producers of milk; (b) the treated cows as well as similar high producers require more food to provide for the calories used in lactation; and (c) the reproductive cycles of the cows have to be managed more efficiently.

Evaluation of considerable evidence has led me to the following conclusions: (a) genetically engi-

neered rbSTP is the same as natural bSTP, although in some cases there is a different terminal amino acid that reflects the initiation amino acid(s) of the molecule associated with synthesis of the protein; (b) milk derived from cows treated with rbSTP is safe for the human infant and adult and is nutritionally similar to ordinary milk; (c) meat derived from cows treated with rbSTP is safe; (d) the prevalence of mastitis and other diseases is no more common in cows treated with rbSTP than in those cows that are naturally high producers of milk; and finally, (e) genetic engineering has given us marvelous medical tools and promises to be even more generally advantageous to clinical practice.

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