

The Future of Biotechnology in the Barnyard

Terry Etherton¹

*Department of Dairy and Animal Science
Pennsylvania State University*

Summary

Since the onset of the modern era of biotechnology in 1973, scientists have made impressive strides in developing new biotechnologies for agriculture (reviewed in *Metabolic Modifiers*, 1994; Etherton et al., 2003). Biotechnologies that enhance productivity and productive efficiency (feed consumed/unit of output) have been developed and approved for commercial use. Technologies that improve productive efficiency will benefit both producers and consumers because feed provision constitutes a major component (about 70%) of farm expenditures. Advances in biotechnology research have allowed impressive improvements to be made in diagnostic approaches, increasing microbial safety of food and improving animal health (reviewed in Etherton et al., 2003). The application of genomics, or the study of how genes (**DNA**) are organized and expressed, and bioinformatics in animal agriculture will provide new genetic markers for improved selection of all livestock species. Biotechnology also offers considerable potential to animal agriculture as a means to reduce nutrients and odors from manure as well as the volume of manure produced. Development and adoption of these biotechnologies will contribute to a more sustainable environment.

Advances in plant biotechnology also have had a huge positive impact on society. An impressive number of genetically modified (**GM**) plant varieties have been developed with improved qualities,

including enhanced tolerance of herbicides, protection against viruses and insect pests, and beneficial modifications in nutrient profile (visit **AGBIOS** at <http://www.agbios.com/dbase.php?action=Synopsis> for additional information about GM crops, and a listing of approved biotech crops in the U.S). Presently, 74 different biotech crops have been approved for use in the U.S.

The discovery and development of new animal and plant biotechnologies are part of a continuum leading to the commercialization of agricultural biotechnology products. In order to enter the marketplace, new animal biotechnologies are rigorously evaluated by the appropriate federal regulatory agencies to ensure efficacy, consumer safety, and animal health and well being (FDA, 2006). In order to benefit agriculture and society, products of biotechnology must be accepted by consumers. Central to consumer acceptance is the need to provide effective population-based education programs to enhance public understanding of biotechnology, as well as the benefits that are realized by adopting products produced by agricultural biotechnology.

Despite some of the most remarkable scientific achievements in the history of life science research, a public discussion still continues about the need for and safety of “biotechnology in the barnyard” (see articles posted at <http://blogs.das.psu.edu/tetherton/>). A recent focal point

¹Contact at: 324 W.L. Henning Building, University Park, PA 16802, (814) 863-3665, FAX: (814) 863-6042, Email: tde@psu.edu



has been the attack on rbST use in the dairy industry, and the marketing efforts driven by some in the dairy industry to promote rbST-free milk. The intent is clear – there are those in the dairy industry who seek to differentiate milk and dairy products into three niches: conventional, rbST-free, and organic, and sell the latter two products for appreciably more.

The ongoing public discussion about rbST has been fueled by misinformation campaigns conducted and funded by a number of anti-ag and anti-biotech activist groups. As animal agriculture moves forward, there is a pressing need to be more proactive in developing and delivering biotechnology and agriculture education campaigns for the public and policy makers that clearly articulate the need for and merits of current production practices that are used in animal agriculture. If we fail to do this, we face the possibility that scientific innovation in the sciences of biotechnology and coupling discoveries to development of new products for animal agriculture will fade away. Some might argue that this is not a future likelihood. However, my perspective is that if the current attack on rbST results in the product “going”, then there will NOT be other private sector companies in the U.S. undertake efforts to develop and sell new products of biotechnology for animal agriculture outside the animal health market. In addition, it is possible that the animal health market will shrink both from an innovation of new science perspective as well as market size/opportunities (i.e., the attack on antibiotic use is one illustration of the latter).

A debate that has not taken place to any extent relates to the future of basic science research in animal/dairy science. If there is no outlet to commercialize new discoveries, then the possibility emerges that federal funding for this could wane – why fund it if it can’t be commercialized? If this occurs, then we will have witnessed science and the scientific method “getting tossed under the bus”. My encouragement is that we in the animal agricultural community champion the benefits of

investing in discovery research that benefits animal agriculture and consumers. At the present time, there are few visible science activists who effectively represent our interests in defending the right to develop and use agricultural biotechnologies in production agriculture.

Recombinant Bovine Somatotropin (rbST) – A Case Study

In this review, rbST will be presented as a case study of a FDA-approved biotechnology that has had an effective tool for increasing profitability and production efficiency. It has been commercially used in the U.S. since 1994 for administration to dairy cows to achieve increased milk yield, improve milk/feed, and decrease animal waste (reviewed by Etherton and Bauman, 1998; Bauman, 1999). I also will discuss 3 other case studies about the rbST-free milk public discussion. These will be used to illustrate what is at stake. At the core of these public discussions have been marketing campaigns in recent months that differentiate milk and dairy products on the basis of technologies and production practices used in production. Collectively, these marketing efforts have used scare tactics and fear campaigns. For example, Horizon Organic Milk claims on their label that their milk contains “no antibiotics, artificial hormones or dangerous pesticides”! Beyond being wildly inaccurate, these “absence claims” confuse and scare some consumers. The intent is clearly to infer that non-labeled milk (i.e., conventional) contains them and “encourages” consumers to pay more for rbST-free and organic milk. In addition, consumer survey data demonstrate that “hormone absence claims” infer that the milk labeled this way is free of hormones. Not only is this not true and misleading, but, as we all appreciate, this creates confusion among consumers especially when no differences exist in safety, wholesomeness, and nutrient/hormone composition of all milk sold at retail (this has been reviewed extensively at <http://blogs.das.psu.edu/tetherton/>). An important aspect of the ongoing



public discussion that seems to be ignored by many is the right of dairy producers to use a biotechnology that improves productive efficiency (milk/feed) and profitability.

rbST-Free Milk - A Story of Smoke and Mirrors: Example #1

The Boston Globe ran a story on Sept. 25, 2006 on the decision by H.P. Hood and Dean Foods to switch New England milk processing plants to “rbST-free” milk. In this story, a spokesperson for Dean Foods said, “Even though conventional milk is completely safe and POSILAC is completely safe, some people don’t feel comfortable with it.” This is the reason given for labeling milk as not coming from cows supplemented with rbST—a meaningless distinction, because all milk contains the same hormones in the same amounts, irrespective of whether they have been supplemented with rbST.

There’s little doubt that consumers who have no understanding are easily gulled by such labels. Evidence of this is in a story in the October 1, 2006 issue of the St. Louis Post Dispatch, which quotes a mother shopping at a Trader Joe’s for her family as she “picked up a package of string cheese in the dairy section, and noted that it doesn’t contain bST, a bovine hormone.” “I’m not sure what it is, but I think it’s something bad,” she said. “I’m pretty certain it’s a hormone, and I try to buy milk that also doesn’t have hormones in it. I’m not one of those people where everything has to be organic. But with my child, I feel like I should get her off on the right food; you know, without pesticides and hormones.”

This illustrates the remarkable lack of scientific understanding that exists in the general public. There are thousands of hormones circulating in the blood of all animals and humans. Without these, we would not survive. Moreover, any technology used that impacts the food chain, like rbST, has been subject to intense regulatory review

by the FDA. The POSILAC (Monsanto, St. Louis, MO) has been one of the most rigorously reviewed technologies that have been evaluated and approved by FDA. Simply put, the use of POSILAC does not pose any increased health concerns for consumers or cows!

In a nutshell, some processors are saying they are perfectly willing to exploit consumer ignorance and suspicion that some milk might be safer or healthier than other milk. Where does this lead the milk industry?

“If the future of our industry is based on marketing tactics that try to sway consumers with ‘good milk’ versus ‘bad milk’ messages, we are all in trouble,” Kevin Holloway, President of Monsanto Dairy, told a group of dairy producers at a September 13, 2006 meeting in Washington D.C. Mr. Holloway has a business to run. That business sells POSILAC to U.S. dairy farmers who have used it ever since FDA approved it 13 years ago, so he’s expected to say something along these lines.

But on October 1, 2006, two letters to the editor of the Boston Globe indicate that Holloway may be the Cassandra of the dairy industry. Under the headline “Hold the growth hormones—in fact, hold the milk,” the Globe published the two letters. One was from the Oregon Physicians for Social Responsibility. They said FDA was wrong and rbST made milk dangerous to the public. They applauded Dean Foods and H.P. Hood for the decision to ban dairy farmers from choosing to use this tool. These activist physicians said it caused “health risks to humans,” though they could cite no evidence of this.

The second letter to the editor was from the staff dietitian for the Physicians Committee for Responsible Medicine. She said that all milk contains hormones, which is very true not only of milk, but of all food. However, her recommendation was that everyone should avoid all milk because “it may boost prostate and ovarian cancer growth.”

This is a great illustration of the type of scientific misinformation that opponents of rbST use.

Both letters were written by parties with motives that are hostile toward the truth about the health benefits of all milk, including milk from cows supplemented with rbST. There is no evidence that milk causes people to have cancer. The reality I have observed is that it is easy to scare the public in a 30-second media message. It is impossible to give them a sound scientific understanding about the benefits of biotechnology in the barnyard in 30 seconds.

rbST-Free Milk – Stealing Your Milk Money: Example #2

Some major national and regional dairy food companies have an ongoing campaign to frighten the public into handing over more of their “milk money”. It’s a simple strategy: use fear marketing to make consumers buy more expensive milk that bears labels hinting it might be safer than other milk even though it is the same. Articles in the New York Times and Boston Globe last fall pointed to consumer demand as the reason for companies, such as Dean Foods and H.P. Hood, refusing to accept milk from cows supplemented with rbST at some of their processing plants. Yet the International Dairy Foods Council, which represents these companies and others, says there is no major consumer concern about farmers using this safe, FDA-approved technology. The claim of consumer demand is a handy smokescreen as these companies slap labels on their milk cartons that claim “no rbST” or “artificial growth hormones” were used to produce the milk. The fact is that well-conducted and unbiased consumer surveys demonstrate that there is no increase in consumer concern about use of food biotechnologies (<http://blogs.das.psu.edu/tetheron/>).

Some might suggest that no consumer in their right mind would feel good about buying milk that might have hormones in it would they? Not if for a few extra quarters per half gallon, they could spare the family from whatever horrible stuff labels imply may be in regular brand X milk. But the bothersome fact that undermines this strategy is this: All milk contains hormones—the same hormones in the same amounts, irrespective of whether the cow has been supplemented with rbST. This includes organic milk and milk from cows not supplemented with rbST. There’s no lab test or scientific analysis that can tell you if milk came from a cow supplemented with rbST or not. That’s because there is no difference.

So how can they get away with this? Clearly, most consumers are unaware of what is going on. But a few have heard the myths spread by activists that claim rbST creates milk that may cause cancer, cause children to enter puberty earlier than normal, or cause women to give birth to twins. There’s not a bit of science showing any of this to be the case.

The much-studied science of unscrupulous marketing tells us that if you can frighten someone or create doubt and then offer them safety from their fear, you can help yourself to their money. You just have to create this fear. What better way to do this than labeling milk with a scary label?

What emerges is a story of smoke and mirrors. Some might call this a con game. According to some milk marketers, it’s called “meeting consumer demand.” Whatever the euphemism, it is wrong to market two products that are identical, and tout one as better at the expense of the other. It hurts farmers and citizens financially, not to mention that this glosses over the underlying science saying that all milk is safe and wholesome.

rbST-Free Milk – Luddites at the Gate: Example #3

As a scientist, I am stunned by the factors that are driving policy-making at every level today - from Capitol Hill, to the boardroom, to the kitchen, decision-makers are increasingly influenced by a constituency whose credibility should at best be questioned and at worst be absolutely dismissed. Evidence and reasoning are in short supply in the debate over rbST. Activist advocacy groups are using fear-based and emotional arguments that are having an impact on our society.

The Organic Consumers Association and their Public Citizen spin-off protégé, Food and Water Watch, are currently at the front of the anti-rBST activity swirling around milk producers, processor, and retailers. Like the Luddites before them, these groups are opposed to change. But unlike the Luddites, for whom change was an implied threat to their livelihoods, the livelihood of these groups actually depends on change. Any advances in science or chemistry are a boon to their efforts, as they need something to oppose in order to stay relevant and keep their fund raising efforts alive. Today it is the FDA approved- and proven-safe-over-a-decade rbST, tomorrow —what?

These “anti” activist organizations are groups whose full-time efforts are devoted to opposing approved technologies that improve our lives, economically and otherwise. They are funded by foundations whose assets run into the billions of dollars. B. Billions. These foundations have a clear agenda, and they give generously to those who share their goals. All the recipients have to spend their money on is advocacy. I should find another word, because advocacy implies that you are “for” something when these groups are really anti-everything. They embody a “take-away” strategy rather than pursue a noble effort that pursues a mission of “adding to” society.

Imagine the impact a corporation with a billion dollar public relations or marketing department could have? Even Starbucks, with all of their socially-responsible caché, was incapable of withstanding the 5-year onslaught from these groups.

And where is the evidence and reasoning, the voices of sanity and reason within the scientific community? Where are the voices of dairy producer groups in the public discussion? As easily as lawmakers can pass legislation that is burdensome for our farmers, they can turn their eye to research, development, and production, and impose restrictions that will put companies out of business and reduce research funds for scientists. I appreciate that part of the silence in the scientific community is really just perception based on the reality that reporters simply do not want to talk about the science. My encouragement is that we in animal agriculture become more proactive in the public discussion about science, technology, and agriculture. If consumers and others were more informed about the science and the scientific evidence base that supports the use of rbST, instead of with fear, there would be no debate at all.

A Look to the Future – What is Coming?

Before we in the animal agricultural community get carried away anticipating scientific advances in biotechnology over the next 40 years, there are several key points that must be considered and addressed. There is the ever present issue of sufficient funding being available for discovery and applied research in agriculture. As discussed herein, scientific discoveries made require a viable private sector to commercialize new products of biotechnology. This is becoming more challenging for the reasons discussed herein. The process of moving a product through the regulatory approval process is becoming more complex, costly, and lengthy. This growing burden makes it challenging for the private sector to recover their investment

costs from product sales. This is particularly important for agricultural biotechnologies where the margins on products sold are lower than biomedical biotechnology products (using comparable scientific methods for production).

The last point pertains to the activist groups that are actively advocating use of biotechnology-derived products be halted. Many of these groups are well funded and attack animal agriculture on many fronts that range from animal welfare to biotechnology to environmental issues. For those who believe that the activist attacks on rbST use in the dairy industry will be the end of the battle, let me assure you that this is only the beginning. The key question is what other technologies/biotechnologies will be attacked next? Will it be antibiotic use? The use of synchronization programs for reproductive management? The use of rumensin? The use of artificial insemination programs? The use of genetically modified feedstuffs? Some activist groups have as a strategic goal to move consumers to a plant-based diet. Given this, the last “technology” to go could well be the cows! Should food production move off-shore in a substantial way, there will be the looming question in the future of whether we can have national security in the absence of food security. The answer to that is simple – NO. My hope is that a large proportion of the American population understands this reality, however, that is by no means certain.

References

Bauman, D.E. 1999. Bovine somatotropin and lactation: From basic science to commercial application. *Domest. Anim. Endocrinol.* 17:101–116.

Etherton, T.D., and D.E. Bauman. 1998. The biology of somatotropin in growth and lactation of domestic animals. *Physiol. Rev.* 78:745–761.

Etherton, T.D., D.E. Bauman, C.W. Beattie, R.D. Bremel, G.L. Cromwell, V. Kapur, G. Varner, M.B. Wheeler, and M. Wiedmann. 2003. *Biotechnology in Animal Agriculture: An Overview*. CAST (Council for Agricultural Science and Technology) Issue Paper, No. 23.

FDA. 2006. A risk-based approach to evaluate animal clones and their progeny – DRAFT. <http://www.fda.gov/cvm/CloneRiskAssessment.htm>

Metabolic Modifiers: Effects on Nutrient Requirements of Food-Producing Animals. 1994. T.D. Etherton (Ed.). Board on Agriculture, National Research Council, National Academy of Science Press, Washington, D.C.

