
TRANSPARENCY IS NOT ENOUGH: THE AQUA BOUNTY EXPERIENCE IN THE COMMERCIALIZATION OF TRANSGENIC SALMON

Presentation to the
Biotechnology, the Media, and Public Policy Conference
Wohlstetter Conference Center, American Enterprise Institute
Washington, DC
June 12, 2003

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ABSTRACT

Aqua Bounty Farms is on track to bring the first genetically engineered food animal to market in the immediate future. Because biotechnology is controversial and because regulatory oversight of animal biotechnology at the US Food and Drug Administration affords little opportunity for public comment during the pre-market consultation process, the company has followed a policy of voluntary disclosure, high media visibility, transparency and public dialog. Although the resulting press coverage has included a high degree of speculative material, it has also highlighted an unusual aversion to risk associated with antibiotechnology activists that is not reflected in consumer behavior. Evidence from agricultural input markets, from consumer buying patterns and from experimental economics is presented to demonstrate that consumers routinely accept biotech foods in the absence of governmental or supply chain barriers to market development.

Aqua Bounty Farms is a small R&D-stage company focused on the application of biotechnology to aquaculture. We use a variety of molecular techniques – recombination, transgenesis, marker-assisted selection, receptor site targeting and others – in a variety of aquatic species, including several salmonid fishes, shrimp, catfish and tilapia. If things go as expected, sometime in the coming 8 to 18 months, we will become the first company in the world to bring a genetically engineered food animal to market.

The animal itself is quite interesting, an Atlantic salmon better adapted to life on the farm than in the wild. Three decades of selective salmon breeding have given the world a very useful new variety of livestock, but one that still carries a quirk of its wild ancestors. Wild salmon feed in the ocean at the edge of the Arctic ice. They feed at the surface of the water column and would freeze to death if they remained on the feeding grounds during winter. So as the northern light fails, it triggers a metabolic slowdown in wild salmon. Growth hormone production shuts down for the season, the fish lose their appetites and move away from the ice to deeper, warmer waters where they wait out the cold weather. Aqua Bounty's salmon inherit a second growth hormone gene, one spliced to a regulator that, in its native Arctic pout is turned on in the winter. So our farm-adapted fish continue to feed through the cold weather months and, in the end, grow to full size twice as quickly as their partially domesticated cousins.

For what it's worth, our corporate history parallels the market introduction of food biotechnology in time and in relation to the fits and starts of regulatory structure, media interest and public opinion. We were organized in 1992, just a few months before one of the pivotal events in food biotechnology's commercial trajectory, when the FDA finally cleared rBST for use in dairy cattle. In 1994, as the gene-silenced FlavrSavr tomato became the first genetically modified whole food to reach the marketplace – at a 2-to-1 price premium, by the way – Aqua Bounty began a dialog with the FDA that eventually led to the agency's "structure and function" decision to regulate transgenic animals under its pharmaceutical rather than food additive standards. In 1996, food biotech reached the agricultural heartland with the launch of commodity soy and grain varieties engineered to resist insects or tolerate herbicides; Aqua Bounty filed its New Animal Drug Application with the FDA that November.

The reference to transparency in my title stems directly from the New Animal Drug approval process which, while arguably the most rigorous procedure available among the three federal agencies that share responsibility for food biotechnology, is certainly not the most transparent (Anonymous 2002). Reasoning from the statutory definition of drugs (21USC321) as "articles (other than food) intended to affect the structure or any function of the body of man or other animals," the agency concluded that an inserted gene and any expression product of that gene not only qualified for regulatory scrutiny as drugs but would, in fact, be required to meet the higher pharmaceutical standard for safety and for efficacy under the language of the Act.

When FDA reviews drug trials it is required to protect any proprietary information associated with those trials under the Trade Secrets Act (18USC1905) which, given the competitive conditions in the pharmaceutical industry, can include even the intelligence that an agency review is underway. FDA therefore gives public notice of its drug decisions and summarizes the evidence supporting the decision only after the process has been completed.

Aqua Bounty's competitive environment is quite different than the pharma model. Our product would be highly novel – the technology still relatively young, the expansion to the animal kingdom unprecedented in the marketplace and even the primary production industry, aquaculture, still unfamiliar to most consumers. We considered the information vacuum that would be created by holding our scientific safety studies confidential at FDA to be a virtual invitation to all comers to fill the gap with speculation and hyperbole.

From the start we had been publishing results of biological and aquacultural interest in professional journals (eg. Fletcher et al. 1990; Du et al. 1992) and had concluded, well before embarking on the FDA process, that there would be nothing to gain under the confidential pharma model and nothing to lose by continuing our policy of transparency. We have followed that policy by voluntary disclosure of our NAD application, by building a high media visibility to explain that disclosure, by direct dialog with credible critics in the academic, regulatory and NGO communities and by accepting opportunities, like this one, to advance our story with opinion leaders anywhere in the world. We are publicly committed to releasing our safety results as they are submitted to FDA, subject

only to the agency's agreement that they are complete and methodologically sound. We intend to carry this policy through the product roll-out with a brand label that will highlight superior product attributes developed through biotechnology.

But transparency has not been enough to stem the flow of speculation surrounding our fish. In part, I think, this is because most of what we have to report is pretty uninteresting. Yes, the fish grow extremely fast in early life and this gives rise to dramatic, side-by-side photographs of juvenile fish. But the size difference disappears by adulthood, there are no giant fish or even big males to monopolize breeding pools. There are no physiological or morphological differences from standard salmon, no differences in anatomy or blood chemistry, no armored gills or antifreeze proteins. This is not the stuff of a compelling news story – and even less of a breathless web site or an effective fundraising letter.

While we have been doing all this transparent, and apparently uninteresting disclosure, the press has delivered its “first draft of history” for biotech food. It is not pretty. In the nature of first drafts, it is an undifferentiated mixture of accuracy and error, science and spin, placeholders and hypotheses. In the nature of journalism, it is narrative first – and everything else second.

I don't mean to suggest that accuracy, fairness, scepticism, balance, and perspective count for nothing. I have rarely met a reporter for whom these core values are not deeply internalized. My point is not about values but about craft -- about the tools and analytical method inherent in the art of the written word.

Writers are looking for stories to tell. Stories have characters, they have plots that test those characters to reveal something fundamental about the individual or the human condition, and those plots have a narrative logic – a pace and a direction – that conducts the reader from the beginning of a story to its conclusion.

Character, conflict and resolution – the writer's path to truth – stand in undeniable tension with the scientific method in the media's coverage of the biotechnology story. Scientific truth, always conditional, owes nothing to the character of a particular researcher, follows no pre-determined plot and produces no definitive resolution.

The missing elements in this story – the characters in butterfly suits and biohazard gear, the vandalized experiments, the irresistible “Frankenfood” metaphor, the search for closure through boycotts, warning labels, moratoria and bans – have been helpfully supplied by a “coalition of the unwilling” professing an aversion to risk that is at the extreme end of the attitudes held across the larger society.

From a market entry perspective, those attitudes toward risk are the interesting part of the media story. Several researchers have commented on the intransigence that characterizes the opposition to food biotechnology, as well as on the tendency of opponents to ignore information that doesn't conform to their existing beliefs (Frewer et al. 2002; Lusk et al. 2002b). This result should not be unexpected in the presence of attitudes that are so basic they are almost diagnostic of personality (Cloninger 1987). The risk aversion of the

lifestyle activist, no less than the risk tolerance of the biotechnology entrepreneur, is not particularly subject to rational discourse because these attitudes are not rational. They are predispositions, emotional expectations, really, through which people view the possibility of gain or loss.

Attitudes toward risk are characteristic in people but they are not entirely fixed. They are subject to some adjustment – toward or away from neutrality – in response to information learned in specific situations (Myagkov and Plott 1997). Nor are people consistently predisposed to avoid or tolerate all classes of risk. The European predilection for both tobacco consumption and for hostility toward food biotechnology is an obvious case in point. But risk attitudes are constant enough, and are reshuffled randomly enough with respect to specific risks, that they tend to be normally distributed in the population over time and observation, possibly due to genetic variation among alternative endocrine pathways that influence mood, attitude and physical reactions to danger (Cloninger 1987). We can be reasonably confident, therefore, that the “Franks and Vandals” in this postindustrial pastoral can’t speak for consumers or predict their behavior, because most consumers tolerate a different level of risk than do their advocates.

There’s a pretty well established discontinuity between the opinions people express in polls and their behavior in the marketplace (Neill et al. 1994; Cummings et al. 1995). Ultimately, the media story influences public opinion, and the poll results are consistent with the volume of coverage and the inevitable emphasis on conflict and risk (Frewer et al. 2002). But core attitudes are more likely to influence buying behavior (Baker and Burnham 2001).

We see opinion and behavior as distinct phenomena, obviously related but probably not in any direct or deterministic way that allows for simple extrapolation from one to the other. And when we look at how consumers behave when given the opportunity to purchase biotech foods, at the price theory of demand, at the diffusion pattern for other innovative technologies, we are confident that consumers will respond to an appropriate combination of branding, pricing and product support in their decisions regarding food biotechnology.

Our commercialization strategy is obviously influenced, not just by the fireworks of the past half-dozen years of strong media interest in food biotechnology but also by the largely untold story of the extraordinary rate of biotechnology adoption wherever markets have been free of artificial barriers to entry.

Bovine somatotropin, for example, entered the U.S. market after a decade of extensive field trials, against vocal and organized opposition, and facing some very aggressive competition from negatively-labeled alternatives endorsed, and in some cases even funded, by state governments. Ten years on, rBST has a 35-40 percent share of the U.S. milk market, while negatively labeled “BST-Free” milk still can’t break above 20 percent.

Transgenic papaya was adopted by a third of Hawaiian farmers in the first year it was available and, 5 years later, accounts for more than half of the state's total acreage, despite the fact that Japan, skittish in polls about food biotechnology, is the principal market for the Hawaiian papaya crop.

And in the big commodity crops – soy, corn, cotton, canola – biotech acreage has expanded from zero to over 145-million acres since 1996, not including the effects of black markets for transgenic soya seeds in Brazil and for transgenic cotton in India. Compare this diffusion rate to the reputedly explosive growth rate of organic farming. Since 1997, in a period of unparalleled expansion for organic foods, the organic acreage planted in the U.S. grew from 1.3-million acres to 2.3 million acres in 2001 (Green and Kreman 2002). This million acre increase in U.S. organic cropland compares with a nearly 90-million acre increase in U.S. biotech acreage over exactly the same period (Fernandez-Cornejo and McBride 2002).

Admittedly, these examples relate to intermediate demand by farmers and not to final consumer demand. Farmers could be wrong and market information is often submerged in the noise that accompanies regulatory and supply chain barriers that inhibit consumer choice. It is also true that input and output markets are linked over time, and that 6 to 10 years of production experience is enough time for even imperfect market signals to travel up and down the supply chain.

Where consumers have been able to choose, of those buying in the different categories,

- 80 percent drink milk blended from rBST and conventional dairies
- 70 percent eat processed foods blended from GM and conventional crops
- 70 percent eat cheese and drink beer fermented with enzymes expressed by modified bacteria, yeast or fungi
- 50 percent eat papayas transgenic to resist ring spot virus
- US buyers overwhelmed the FlavrSavr supply chain at a price premium
- UK consumers made GM-labeled, pulp-enhanced tomato paste a retail category leader

These cases cover the range of information environments, from GM labels to GM Free labels to organic labels, but they all describe markets that provide consumers with choices among alternative products, an awareness that those products are available and access to those products in a routine and seamless way. The market signal to noise ratio is better here than in the input markets but the market itself is still too thin to be entirely convincing.

So we also look at consumer behavior through experimental auctions that allow consumer panels to buy and sell GM and nonGM products, and often to keep any auction winnings after the experiment ends. USDA has just reported an experimental auction pairing two suites of three GM-nonGM products that resulted in a 14 percent average discount for the GM suite to clear the market (Tegene et al. 2003). Earlier, an experimental chocolate auction involving French consumers reported a 30 percent discount to be sufficient to persuade 80 percent of the panelists to purchase GM chocolate (Noussair et al. 2002). Interestingly, the French auction offered two versions

of the same chocolate bar, one labeled GM and the other GM-free, but didn't call attention to the labels in the first round of bidding. Bids were identical in this round, with any discounting or refusal to buy emerging only after researchers called attention to the labels.

But other auctions have revealed that consumers who receive positive information about the benefits of food biotechnology may actually place a premium on GM-labeled foods (Lusk et al. 2002a). With a more realistic mixture of positive and negative information expected discounts averaged 23 percent in one auction, and adding neutral, third party information to the mix reduced the expected discount to a range of zero to 11 percent. Only in the presence of exclusively negative information did discounting reach 35 percent (Rousu et al. 2002). Information about the benefits of food biotechnology associated with reduced pesticide use and food security benefits to the developing world significantly influenced consumer acceptance and discounting (Lusk et al. 2002b)

Whether GM foods must inevitably be discounted to gain consumer acceptance, at what price and for how long are all interesting but ultimately empirical questions that will keep food marketing professionals gainfully employed for a few more years. The point here is that consumer panels, even in Europe, make a market for food biotechnology when they are given the opportunity.

The behavioral evidence – from input markets, from supermarkets and from auctions – appears to be as uniformly positive as the opinion-based evidence – from polls, the press and the political arena – is uniformly the reverse. It's not at all clear that consumers have rejected food biotechnology, as the activist narrative insists. It is clear that artificial barriers to market entry, whether constructed by the EC, Sainsbury's or Robert Mugabe, prevent consumer choice and distort the clear channel carrying market information between farmers' input choices and consumers' behavior in the supermarket.

The simple fact is that food biotechnology has always been controversial – for some people. So were pasteurization, atmospheric nitrogen fertilizer, inbreeding hybridization, microwave ovens and winter tomatoes in New England – for some people.

For those accustomed to tracing biotechnology's challenging public relations environment to European regulatory failures in the middle 1990s, or who subscribe to the curious activist fiction that biotech developers themselves sabotaged the technology rollout through secrecy, let's remember that rBST – although first through the regulatory gateway in 1993 – was nearly beaten to market by Calgene's FlavrSavr tomato in 1994. The interim year was filled with a Congressional moratorium on BST marketing, hardly a sign of secrecy, of suppressed dissent or of controversy-free consumer acceptance.

And this – much as I hate to admit it -- is why the media story matters. It's not really scaring consumers, in the sense that it has more than a temporary effect on buying behavior. It is scaring retailers and politicians into erecting market barriers that do interfere with consumer behavior, with production decisions and with the free flow of information that links the two.

I mentioned at the outset that Aqua Bounty Farms is committed to transparency – through the regulatory process and beyond, with a product label that clearly identifies the benefits of biotechnology embedded in our fish. But we want to write that label ourselves and, quite frankly, the California Attorney General and the European Commission are not on our short list of copywriters.

In this regard, the fate of the French chocolate auction is quite instructive. This study was done under the auspices of a stakeholders consortium that included 60 organizations ranging from Monsanto to Greenpeace. When the consortium got through with the study, the salient features were not that 80 percent of the participants purchased GM chocolate or that none of the participants – including the 20 percent who boycotted GM – were concerned enough about food biotechnology to even read the label. The consortium's conclusion was that GM foods in Europe should carry a larger label.

A key element of the anti-biotech strategy has been to convince farmers and investors that consumers will never accept "Frankenfoods" so why risk capital on R&D or commit farm resources to an unsaleable crop. To this end, activists organize product boycotts, sponsor phony investment analyses, intimidate retailers and divert attention from consumer behavior in real markets. While many have criticized the media for playing up activist scare tactics and amplifying risk, most reporters try to balance their stories with comments from scientists who provide a calmer perspective on the fear du jour. The real damage arises in the media's uncritical acceptance of the stealth message to investors, farmers and stores. Like the French chocolate consumers who never noticed the label, the media have missed the point of this exercise in their haste to swallow the treat.

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