Transgenic Animals: Genetically engineered meal close to your table

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Global Research, November 23, 2008
Toronto Star 22 October 2008

Theme: Biotechnology and GMO

The pigs, pale pink and bristly, trot around the pen, stopping every so often to root in piles of bedding. They grunt and squeal and wag their short curlicue tails. All three like a hard scratch on the rump.

In almost every way, these broad-backed oinkers are just like the other Yorkshire pigs at the opposite end of the barn.

All except for the brackish green muck that oozes from their backsides. And the snippet of mouse DNA that has been slipped into their piggy chromosomes.

These are Enviropigs, developed by researchers at the University of Guelph to poop out more environmentally friendly waste. The trademarked pigs are just one of dozens of genetically engineered animals at research institutions around the world whose genes have been altered for human benefit. And, due to a recent move in the U.S., the Enviropig may be the first to arrive on your dinner plate.

Two months ago, the Food and Drug Administration released draft guidelines that outline how genetically engineered animals will be regulated. The agency, which asked the public to weigh in on the proposals, closed the 60-day comment period on Tuesday.

Regulators are now sifting through the thousands of comments, many of them raising troubling questions about how so-called supermeats get to market.

As the guidelines stand now, companies do not have to conduct human trials to test the safety of transgenic meats. Nor do they have to specially label products made from genetically engineered animals. And many consumers are outraged that transgenic meats could end up in their grocery cart without their knowledge.

Despite concerns, experts say the FDA's much anticipated document, the first of its kind issued by a federal government, will be the catalyst for moving genetically engineered livestock from the experimental farmyard to the supermarket.

Proponents of transgenic animals – whether faster-growing fish, special-milk-producing cows and goats or healthy-for-you-pork producing pigs – say they herald a new era of food production. FDA officials say genetically engineered animals hold "great promise" for improving human medicine and the environment. The made-in-Canada Enviropig, for example, could clean up hog farms around the world by drastically reducing a major pollutant found in pig waste.

But here in Canada, regulators have yet to announce how they plan to regulate genetically engineered animals, though officials may act soon after the U.S guidelines are finalized. A spokesperson for Health Canada, the agency responsible for establishing these guidelines, said officials will liaise with the FDA on the issue. Until regulations are in place, foods derived from transgenic animals will be prohibited – even if approved by the FDA.

For Cecil Forsberg, one of the University of Guelph scientists who developed Enviropig, the FDA draft guidelines open the door to corporate investors interested in their trademarked animal. Food companies, he says, have been slow to back genetically engineered animals without a clear approval process.

“Industry was not sure what was required,” he says. “Without hope of approval, transgenic animals would be a bottomless cash pit.”

The first Enviropig was born at the university farm in 1999. Unlike the rest of his litter, this piglet had a bacterial protein, called the phytase gene, attached to a piece of mouse DNA that locked into his chromosome. The scientists hoped the phytase gene would make the pig produce an enzyme to help it better digest plant phosphorous, a vital nutrient in their feed. The mouse DNA was used to kick start phytase production in the pig’s salivary system.

The genetic engineering worked.

Enviropigs are able to digest the plant phosphorous more efficiently, which means there is less phosphorous – up to 60 per cent less than ordinary pigs – in their waste. That, in turn, means less phosphorous will leach from pig manure, a major fertilizer source for farmers, into freshwater lakes and streams where it can trigger vast algal blooms and kill fish.

Forsberg says Enviropigs will be a valuable alternative to conventional pigs, especially since most industrial pig farms operate on a massive scale and leave a huge environmental footprint. Last year, Ontario farmers raised 3.9 million hogs, each producing a possible 450 kilograms of waste every six months.

“We feel that it really has global significance,” says Forsberg.

He and his colleagues have already submitted reams of research on the Enviropigs to the FDA. They say they have enough evidence to declare Enviropigs safe to eat, since chemical analysis has shown the animal’s tissue composition is the same as an ordinary Yorkshire pig, and the introduced bacterial protein is not found in any major food tissues, such as the ham, loin, heart and skin.

They also have shown the engineered trait is successfully passed down to offspring, that the genetic engineering does not harm the pigs in any way, and that Enviropigs do not damage the environment. These evaluations are required under the FDA’s draft guidelines.

No one can say for certain when – or if – the Enviropig will be approved, but industry experts predict it will be one of the first transgenic animals approved in the U.S., possibly in 2009. The FDA plans to regulate genetically engineered animals the same way they regulate new animal drugs. Officials will evaluate each new animal on an individual basis and continue to monitor it for safety once approved. Products that prove unsafe will be pulled from the market.

Scientists who develop transgenic animals say the FDA's proposed guidelines are strict, which should help boost consumer confidence in the products. They point to the government's successful regulation of genetically engineered plants, which have been on the market for more than a decade, and the fact that the FDA declared meat from cloned animals safe to eat last January. Health Canada, however, has not approved the sale of meat from cloned animals.

But critics say the proposed guidelines are too lenient and the approval process too secret. They also contend the FDA does not have the expertise or resources needed to properly evaluate the new technology, especially when it comes to environmental protection.

"There are some safety issues that are not well covered," says Gregory Jaffe, the biotechnology project director at the Center for Science in the Public Interest, a consumer group based in Washington, D.C. "They may not be an expert on all of the animals or have the legal authority to address some concerns. Their statute does not give them any environmental legal process."

A key concern with transgenic animals is they will escape captivity, breed with their conventional cousins and pass on the engineered genetic trait. Transgenic faster-growing salmon, for example, could out-compete wild salmon for food and mates, endangering native fish stocks.

Amid the swirling scientific concerns, perhaps the biggest question of all is whether or not consumers want genetically engineered animals in grocery stores at all.

Surveys show the majority of Canadians are wary of genetically engineered animals. That guardedness is reflected in a growing trend that sees consumers looking for more organic, locally sourced or non-industrially farmed products.

Right now, governments don't consider any of the ethical, social and religious issues with genetically engineered animals, says Sarah Hartley, an adjunct professor of political science at Simon Fraser University who is co-editing a book on perceptions of animal biotechnology. Many people, she says, are concerned about animal welfare, the intensification of industrial agriculture and general reach of biotechnology into their home and onto their dinner plate.

"For some religions, taking a pig gene and putting it into a fish would be problematic."

Instead of joining in the ethical debate, regulators have decided to leave those tough questions up to consumers in the marketplace. The problem with that philosophy, Hartley says, is that the U.S. – and likely Canada, when they release their guidelines – will not require companies to label foods made with genetically engineered animals.

"It's almost impossible for the public to make those value choices without labels," she says. "They want to know which meats, what milk and what cheese is developed from genetically engineered animals and what is through conventional. That will be the biggest issue and I think it's entirely justified."

Despite ethical concerns, Ronald Stotish, the CEO and president of Aqua Bounty Technologies, based in Waltham, Mass., is confident genetically engineered animals will make the leap from the lab to the farm – and soon.

"It's the way of the future," he says. "This technology has the capability of making beneficial

changes in production agriculture."

Aqua Bounty Technologies has spent more than 10 years developing a salmon that can grow to market size in half the time of conventional farmed salmon. Their AquaAdvantage salmon is an Atlantic salmon that has been engineered to carry an extra growth-hormone gene from a Chinook salmon. That extra gene makes the AquaAdvantage salmon grow year round, unlike conventional Atlantic salmon which only grow during warmer months. Stotish says the engineered salmon will make fish farming more efficient, a boon to producers and to consumers, who can continue to buy cheap salmon.

"It is an opportunity that we have to take if we want to maintain our current quality of life," he says.

Yet even as the seventh generation of Enviropigs jostle in their pen – healthy and likely just months away from being declared safe for the dinner table – Forsberg knows the animals aren't out of a research facility yet. It will be up to the consumer to unlock the barn door.

"The big question used to be 'Can we do it?' " he says, arms crossed and a wry grin on his face. "Now, it is 'If we produce it, will they eat it?' "

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