

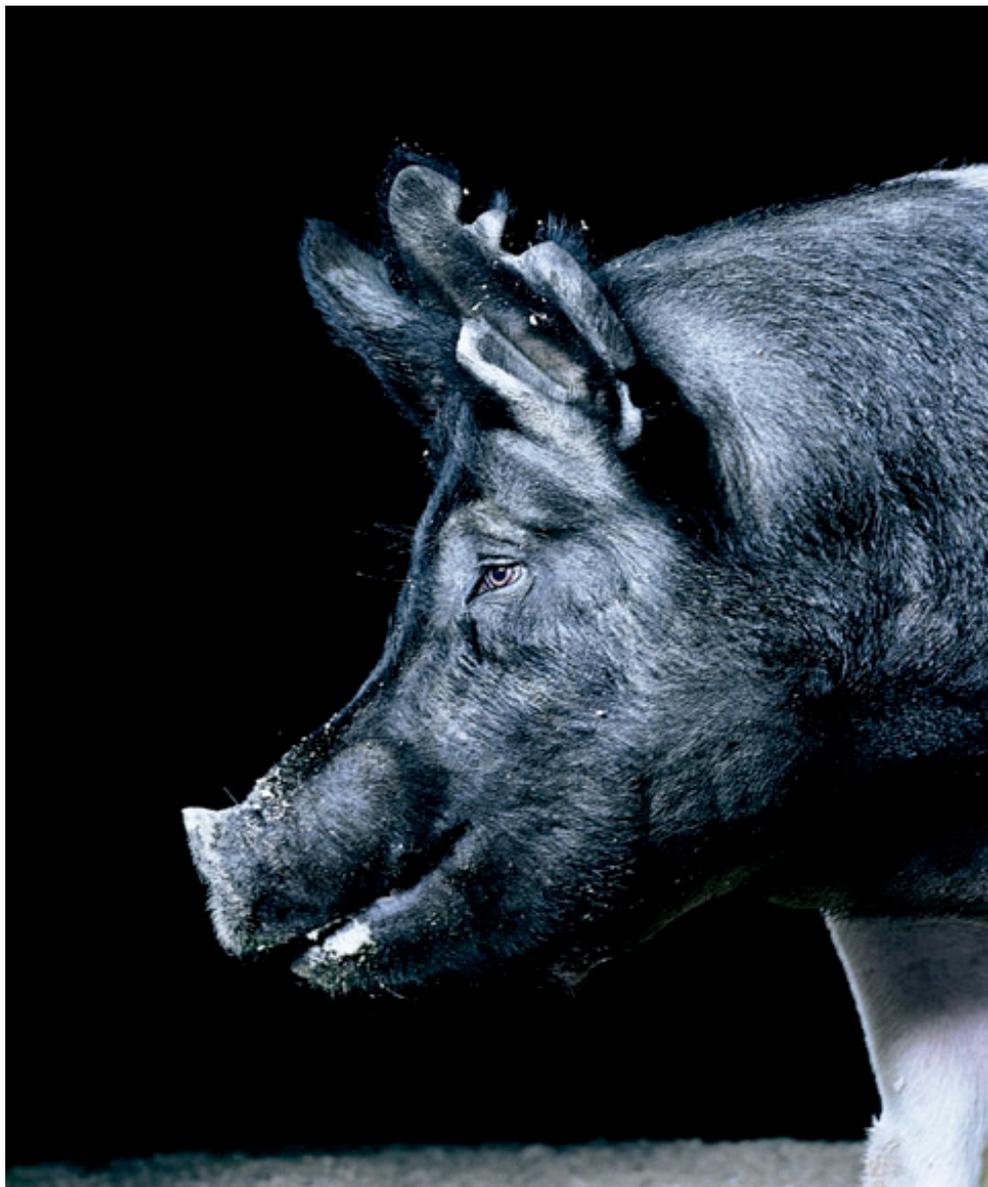
# WIRED

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## Cloned Beef (and Pork and Milk): It's What's for Dinner

By Ben Paynter 10.16.07 | 4:00 PM



*Photo: Alessandra Petlin*

**Karyn Schauf sets a frosty glass of milk** on the red-checked tablecloth in front of me; a plate of Oreo knockoffs sits beside it. Two identical cows prance across the glass. In fact, nearly everything in the kitchenette — plates, cookie jars, wallpaper trim — is emblazoned with cows. And why not? We're next door to the Schauf's 99-cow milking stables, Indianhead Holsteins, in Barron, Wisconsin.

I swirl the glass: A thick lather coats the sides. I sniff: It has a rich, almost buttery aroma. I hate the idea of milk over ice, but the drink is on the rocks because it was squeezed in a steamy, unpasteurized froth just half an hour ago from Mandy2, a 5-foot-tall behemoth with hindquarters as big as truck wheels and a posterior as flat and broad as the tailgate of a pickup. Her massive bone structure supports an udder the

size of a beer keg, capable of producing more than 15 gallons of milk a day.

I sip: The milk tastes crisp and creamy, almost velvety — probably because it's fresh and raw. I dunk a cookie, and it gets soggy fast; when I bite into it, it feels like a chocolate milk shake on my palate. Schauf tips her own glass to her lips, chugs it in two big gulps, and sighs loudly.

"You don't have to drink all that if you don't want to," she says. But I do. Mandy2 has outdone herself. Her milk is delicious. There's no reason it shouldn't be, but I'm surprised.



### *Wired Science* Episode 103: Got Clones?

Dolly the sheep made headlines more than a decade ago, but a cloned steak has yet to make it to the American dinner plate. We visit with a rancher and dairy farmer who are ready to bring their cloned-animal meat and milk to the public, and talk to scientists about what being a clone really means.

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That's because Mandy2 is a clone. She was conceived in a laboratory seven years ago and purchased last summer from a farmer in Illinois. Because creameries were creeped out by her mad-science heritage, Indianhead was able to pick her up on the cheap for \$2,800 — about \$1,000 less than a non-clone adult cow of the same age (calves cost much more — older animals depreciate like cars).

The Schaufs have owned Indianhead for 26 years. They aren't afraid of science, and they know a bit about cloning. In the mid-'90s, Indianhead was a leader in the Wisconsin dairy industry, relying heavily on a Holstein named Blackrose. She — and her daughters — could churn out huge volumes of milk, rich in protein and butterfat. By 1999, when Blackrose was nearing retirement, the Schaufs had heard about Infigen, a now-defunct cloning company with a too-good-to-be-true sales pitch. Using just a pinky-nail-sized chunk of animal skin and a process called somatic-cell nuclear transfer, Infigen would replicate your favorite cow or pig.

Karyn's husband, Bob, had concerns about playing Creator, but he reconciled them beneath the 8-foot-tall cross affixed to their barn. "God gave man dominion over animals," Bob says. As for Blackrose: "She was getting old and we wanted to keep the factory going. Sometimes you never get one quite as good as the old lady." The Schaufs corralled two more farmers as investors, and in 2001 each received a Blackrose duplicate. Indianhead had a new mascot: Blackrose3.

For several years, the Schaufs sold milk from Blackrose3's offspring — conceived via artificial insemination but having the traditional number of parents, two, and possessed of the same talent for butterfat as the original Blackrose. But in April of this year, the local creamery that processed that milk into cheese for distribution throughout the upper Midwest dropped Indianhead. Another client had complained about the "clone farm."

The problem is that the FDA never actually approved the introduction of meat or milk from clones or their offspring into the human food chain. In 2002 the National Academy of Sciences issued a report saying clone meat was safe, and in December 2006 the FDA called duplicate animals and their offspring "as safe to eat as food from conventionally bred animals." But the agency continued to ask producers to keep clones and their offspring out of the market. You can make 'em and you can milk 'em. You can sell them to other ranchers, and you can even eat 'em, if you want. But the FDA really, really doesn't want them in supermarkets — and typically, the industry does what the FDA wants.

In 2006, Stephen Sundlof, director of the FDA Center for Veterinary Medicine, told *The Washington Post* that approval could come by the end of 2007. But the agency has since backed off that timeline. "The FDA is in the process of updating the risk assessment and reviewing the public comments," spokesperson Laura Alvey says. "There is no estimated timeframe on when this will be finished."

Clones were supposed to revolutionize breeding methods, taking the guesswork out of animal husbandry and ushering in a new era of plentiful, delicious steak and bacon. The availability of genetically identical copies of animals would upend the economics of ranching, edging out the old model based on selective breeding and artificial insemination. But consumers can't get past a visceral revulsion at eating clones or the offspring of clones, or even drinking their milk. Part of the FDA's foot-dragging can probably be chalked up to the more than 145,000 public comments the agency has received opposing the sale of clone meat. Meanwhile, health problems continue to plague the clones themselves.

The farmers who bet on that world of wonder-meat have seen their custom-built workforce blacklisted and their financial hopes turn to gristle. Tired of waiting for the future, many are throwing up their hands, grabbing a fork, and eating their profits.

On the day I visit Indianhead, the Schauf's 17-year-old son, Jacob, is showing a red cow named Rvnge Fire, a granddaughter of Blackrose3, at a local 4-H event in the nearby town of Rice Lake. A win here would add to the dairy's cachet — and to Rvnge Fire's potential price at auction. Born later than some competitors in her class, Rvnge Fire looks small, like a station wagon parked between SUVs. But despite defecating in front of judge Peter Coyne, she wins the first-place blue ribbon. Coyne grabs a microphone, gushing that Rvnge Fire is "extremely angular all the way through," with "strong posturing" and "a good set of feet." "She places well above the rest of the class," he tells the rows of wrinkled farmers lining the bleachers.

After the show, I tell Coyne about Rvnge Fire's pedigree.

"I had no clue who the calf was," he says. He pauses for a moment. "I would say that the uniqueness would add value to it."

But who would buy her if they couldn't sell the milk?

Coyne is a polite man, and etiquette in this part of the world says you don't criticize what someone else does with their own time and money. "I do believe there's beginning to be a shift," he says finally. "But it costs an awful lot to clone cows, and with the moratorium... A number of dairymen are still unsure that it makes sense."



Milk from Mandy2, a cloned dairy cow.

*Photo: Alessandra Petlin*

**Don Coover watches** his assistant toss the last of his clone-offspring T-bones onto the barbecue. We're standing on the sidewalk in front of his semen-shipping business, SEK Genetics, a pitched-roof office building amid a patchwork of fields near Galesburg, Kansas. Coover is dressed in denim and wears a dusty ball cap that says GENETIC HORIZONS! — the original name of his company. He doesn't cook out much: The words "Wash Me" were long ago smeared into the oil on the grill lid and have refilled with dust.

As the steaks pop and spit, Coover explains the sperm business: Ranchers don't care about animals, per se. They care about traits. Lots of meat on the bone, high butterfat content in the milk, resistance to disease — these are all desirable traits. And the way you get more animals with better traits is breeding together the good ones you already have.

Trouble is, cattle are hard to move around. They're heavy and stupid. But genetic material comes in a simple package, and it's reasonably easy to get if you have a strong stomach and own a fake cow vagina or an electric prod sized to fit up a bull's anus.

What's not easy is keeping semen fresh. In the early 20th century, ranchers and businessmen tried everything — they packed it in dry ice and alcohol, they rushed samples to their destinations by tossing them out of airplanes in parachute-equipped boxes. None of it worked very well. But in the 1950s, the first modern sperm banks arose, and cryopreservation of semen using liquid nitrogen made it transportable. Researchers developed assisted reproductive technologies like artificial insemination, multiple ovulation, and embryo transfer to customize herds in a matter of years, not generations.

The birth of Dolly, the first cloned mammal, in 1996 made all that seem almost quaint. Instead of gambling on the genetic shuffle that happens when you cross two animals, you could just grab a cell from a moneymaker, scoop out the nucleus, and implant that genetic core into an egg from a donor cow. Give the egg a shock to trick it into thinking it's just been fertilized, and bang — you have a twin. By the late 1990s, farmers were banking cell lines, waiting for the right time to resurrect their animals.

Coover, who wears a West Point class ring emblazoned with a caduceus (he's trained as a vet), bought SEK Genetics from a neighbor in 1995. Six years later, Coover found an Oklahoma rancher with a durable, all-black Chianina show bull named Full Flush. In return for \$35,000, Coover got part interest in five clones of Full Flush — or, more specifically, exclusive rights to sell their semen. Agriculture students came from as far away as Texas A&M to see the little clone herd that industry magazines called the Dream Team.

When the meat is done cooking, Coover and I each slide a steak onto our paper plates and head into the office to sample it. My inch-thick slab is an unpalatable cadaver-gray. I have to saw gingerly to avoid snapping my plastic utensils. I make two perpendicular incisions in the meat. When it seems loose enough, I pinch a small chunk between my fingers and start twisting in circles to get it loose. I pop a morsel into my mouth and immediately regret it — it tastes spongy and stale. I try not to gag.

Coover moves his plate from the table to his lap for more torque. "I can't even cut this," he grumbles to himself. Prying loose a wedge, he bites into it and winces.

"This is terrible," he says matter-of-factly. He chuckles. "Now I know why they were still in the freezer."

I ask if the taste and texture are functions of the meat being from a clone. He checks a date on the label: The meat was frozen in early 2006.

"It's probably a function of being in the freezer for about three years," he says, exaggerating.

Our meal comes from an offspring of a Full Flush clone. The cow was lame, so Coover, fearing that it would be trampled at auction, butchered it. He now has just four Dream Team progeny left at his ranch (though he still has Dream Team semen on ice). Coover says he shipped the rest of his lot to market.

"Wait. You mean into the food chain?" I ask.

"I never worried much about it," he says. "Unless you tell them it's a clone, no one can tell."

After the National Academy of Sciences report in 2002, Coover started selling his own Full Flush progeny to meatpacking plants and hawking clone sperm to a network of undaunted farmers. He calls the idea that the resulting meat might be unsafe to eat "total bullshit."

"The FDA has never made a decision, but that's because of politics, not science," he says. Besides, keeping clone offspring out of the food chain is "impossible to police."

Other cloners are chafing against the FDA's inaction. Farm-tech company Cyagra sent its clients clone-meat summer sausage as a gift. And two years ago, the company took beef left over from 11 clones created for the FDA's risk assessment study and served it to employees. "If you believe in the technology and you believe it's safe, then there's nothing wrong with eating the meat. Second, it just seemed like a huge waste to have it all destroyed," says Steve Mower, Cyagra's director of marketing.

Like it or not, guys like Don Coover have already turned meat-eaters into a test market for the safety of cloned meat. "It's inevitable that there are large numbers of clone progeny in the food supply," says Blake Russell, vice president of sales and business development at ViaGen, another cloning company. "The likelihood that anyone could credibly say 'Our animals are not descended from clones' is zero."



A cloned dairy cow at Indianhead Holsteins.

*Photo: Alessandra Petlin*

The reason cloning makes economic sense isn't that ranchers will sell the actual clones for food. The idea is to sell their offspring. Artificial insemination and semen-shipping have made breeding for optimum genetics a highly profitable business. The owner of a champion bull can charge top dollar for its breeding services or its descendants. Eventually, of course, that animal will get too old to reproduce. But if you clone it, you can keep that revenue stream open. Clones can be bred just like their progenitors, spreading those

popular qualities further into the gene pool. "Part of the value of cloning is that you're buying something with unique genetic potential. It's almost like brand identity," says John Lawrence, an extension livestock economist at Iowa State University. "In many regards it's less risky, because you can say you have a proven animal."

Today, it costs about \$1,500 to raise a naturally conceived dairy heifer from conception to breeding age; it costs roughly \$17,000 to clone a cow. The figures are about \$200 versus \$4,000 for hogs. (The price drops if you make multiple copies.) But with natural or assisted reproduction, roughly 5 to 10 percent of all females and 50 percent of all males bred for better genetics don't inherit their parents' best qualities and must be sold at a loss, as "salvage" animals. Cloning, on the other hand, almost guarantees the high-fidelity replication of desirable traits. So the clone of a champion bull has higher downstream breeding potential than, say, that bull's brother. If the original bull was a good breeder, then the clone's semen sells for more and its offspring are worth more. For hogs, the numbers add up fast: Through artificial insemination, one boar can impregnate 400 sows a year, yielding about 4,000 piglets. But if that boar was cloned from a proven superior male, its progeny will be worth about \$6 more per piglet in "improved feed conversion, growth rate, survivability, and meat quality," says Russell of ViaGen. "So a \$3,000 investment in cloning can create \$24,000 in added value per year."

Coover is trying to make the math even more favorable for cattle ranchers by turning cloning into a DIY affair. After lunch, I sit shotgun in his boxy 1994 Chevy pickup as he plows through waist-high prairie grass about 15 miles from his office. The truck has a large, hydrant-shaped feed dispenser mounted on the bed. He doesn't like AC, so our windows are down, filling the cab with hot wind and dust. Coover spots about 25 crossbred Angus cattle grazing beneath a tree on a distant ridge and blares his horn.

He slams on his brakes and whips the truck around. "It's the boss! It's the boss!" he shouts, waving his arms maniacally to get the animals' attention. He checks his rearview mirror — the herd spots the dispenser and makes the connection: Dinner is served! They stampede. Coover accelerates, and we bounce across the field at 5 miles per hour, lurching toward a gated pasture about 200 yards away.

Coover leads the herd into the pasture and pulls up beside a long, narrow feed trough set between a toolshed and a couple of rusted grain bins. Hopping out of the truck, he angles the slide of the dispenser outward, moving fast to avoid being crushed by the cattle. An animal groans, unleashing a loud, steady stream of urine. Coover gets back into the cab, hits a switch on his dashboard, and drives forward slowly as feed pours out of the hopper.

This has been more than just a ranch chore. Coover is looking for some old friends: his last surviving descendants of Full Flush clones. Their bodies are huge, raised high off the ground to support maximum meat yield. It's an obsolete body type — ranchers today want shorter, stockier cows that require less feed. So Coover has repurposed the clone offspring into surrogate moms. He paid \$12,000 for 60 embryos cloned from cattle around the country, shipped overnight from Cyagra. He implanted them himself — it helps to be a vet — with the hope of slashing the sticker price of cow copies to about \$3,000 a pop. That's right: Coover has implanted clone embryos into the offspring of other clones. It's hard to imagine what the animals' pedigree chart will look like.

Coover reaches out and gruffly pats one of his man-made cows on the muzzle. She munches feed, drooling slightly. Both eyes roll upward to get a good look at him. She has a yellow ear tag for identification, but he doesn't check it. They all look pretty much alike to me, and I ask Coover how he knows he's got the right cow.

"She's just a good cow," he says. "She looks different. She's an individual."



A clone-offspring pork chop from Earnhart Hamps

Photo: Alessandra Petlin

**Second-generation** pig farmer Steve Earnhart is convinced that clone-derived meat tastes different only if you know about its heritage. So he's turned my introduction to clone-offspring bacon into a blind taste test.

The timer dings on his microwave. Earnhart pulls out a plate with four strips divided into two courses. On the right side lie two fat ribbons of meat. On the left, two strips that look more charred and have curled up like question marks. One side is cut from the offspring of a clone; the other isn't.

When I pick them up, the strips on the right bend limply, looking like flat, translucent alien fingers. They're obviously undercooked. My first bite squeaks greasily between my teeth with overpowering notes of wax and salt. The curled batch, though, crunches reassuringly, exuding a familiar smoky flavor that grows stronger and heartier the longer I chew.

I point to the alien fingers. "That's the clone."

Earnhart shakes his head. "It was the other one," he says in a clipped drawl. "Only difference you taste is the cut of the meat."

A burly guy in a plaid shirt and Dickies, Earnhart runs Earnhart Hamps, a 150-sow breeding operation in Albion, Indiana. He sends 1,500 hogs — about 270,000 pounds of meat — to market every year. Earnhart is unique among clone-pig farmers simply because he's still in business. Sows can reproduce more than twice as often as cattle, and their litters are 10 times as big, meaning most of the pig farmers who engineered herds at the start of the clone boom had entire proto-farms ready for market in a year and a half — long before anyone wanted to buy them, even if the FDA had approved. Many of those farmers have stopped breeding clones.

Earnhart didn't have the chance to breed unwanted goods. His first foray into cloning was a science fiction disaster. In 1995, his meaty black-and-white Hampshire pig named Mohican sired a boar that sold for \$40,000 at the Indiana State Fair. "That gave me money to play with," Earnhart says.

Mohican, named after the action-romance flick *Last of the Mohicans* because he was the only one to survive when his mother accidentally sat on and crushed the rest of his litter, was talented enough for a sequel. In 1998, Earnhart cut off a piece of Mohican's ear and had it frozen. Four years later he called up ViaGen and ordered a four-hog tribe expansion. He didn't tell other farmers, for fear of being seen as some city-boy elitist. "This is not a fancy operation," he says, shrugging. "By no means."

Within weeks of delivery in September 2002, the first piglet got sick and died. Another dropped dead two months later. A few days before Christmas, Earnhart walked into his heated barn at feeding time and spotted his last two piglets belly-up in the straw. The cause of death was apparently their identical, adult-size ulcers. "I felt sick," Earnhart says. "I thought maybe someone was telling us we shouldn't have done this." ViaGen promised to ship replacements, but Earnhart says he was told that two more litters had died at the lab.

The demise of the Mohicans may have resulted from a well-known, poorly understood side effect of somatic-cell nuclear transfer called sudden death syndrome. Genes from adult progenitor animals sometimes manifest themselves too early in their clones; Mohican might have had hereditary ulcers that his

piglet doppelgangers developed prematurely. Earnhart won't speculate — the reasons don't really matter to him. "It just nearly killed us," he says.

Problems like sudden death syndrome are why the Humane Society, the Consumer Federation of America, and the Center for Food Safety have asked the FDA to ban cloning or mandate "clone-free" labels at supermarkets. According to the FDA's risk assessment, many animals created with the SCNT process have an "increased risk of adverse health outcomes" over other animals born via assisted reproductive technologies. Clones also suffer from large offspring syndrome, meaning they grow dangerously fast inside their surrogate mothers.

According to Jaydee Hanson, a policy analyst with the Center for Food Safety, those mysterious disorders point to the real question holding clones back: What if? What if clones become ubiquitous and then turn out to be preferentially vulnerable to some emerging disease? And what if eating those clones makes people sick, too? "They need to look at multi generational studies of these animals to see what happens as they breed," Hanson says.

Konrad Hochedlinger, a biologist at Massachusetts General Hospital's Center for Regenerative Medicine, says the birth defects and early deaths are proof that SCNT is an "inefficient and faulty process." But clone offspring, he says, are conceived naturally. That "resets" the chromosomes of the animal to an age-appropriate mode. "Any abnormalities you see are erased in the next generation," he says. "In terms of food safety, it's not really a problem. The meat is the same." Despite the "ick" factor in the marketplace, that's pretty much the party line at the Biotechnology Industry Organization, too — Barb Glenn, BIO's managing director of animal biotechnology, says she still thinks the FDA will come through with that approval before 2008. The National Cattlemen's Beef Association, a powerful industry lobbying group, wouldn't mind seeing clones in the food stream — with nary a label. There's no special supermarket shelf for artificial-insemination-derived steaks, says Joe Schuele, the NCBA's spokesperson. "We don't have it because it's not necessary."

The afternoon after our bacon breakfast, Earnhart pulls on his galoshes to show me his clones at work. The day is hot and humid, and flies rise like storm clouds over pens of manure. We plod over to a metal shed to meet a pig: a pregnant sow panting on her side in a thick metal cage. She's a clone, one of 10 copies Earnhart received as compensation from ViaGen in September 2005. Earnhart bows over the sow like an expectant father. He is considering sending the piglets to market, though he might also breed them, just as he has bred the piglets from his other cloned sows. "If we don't send them to market, there's nothing profitable to be done with them."

Well, there's one thing. Earnhart and I head back to his house for an early supper: pork chops with cheesy potatoes, biscuits, and lemonade. My fist-sized chop is glazed in a sugary, thick-as-molasses marinade. It tastes better than anything I've had at a restaurant — moist, succulent, and wonderfully tender.

"When we go out and pick a hog, we usually try to pick out the best one," Earnhart says. He points to the plate. "This is the one we want to eat." Whether it's born of a clone, Earnhart won't say. "If you can tell the difference, it's in your head."

*Ben Paynter ([paynter.ben@gmail.com](mailto:paynter.ben@gmail.com)) wrote about paintball war games in issue 15.06.*